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BUREAU OF PUBLIC WORKS



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QUARTERLY BULLETIN

BUREAU OF PUBLIC WORKS
MANILA, P. I.

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THE PROVINCIAL DIVISION, UNDER THE DIRECTION OF
THE DIRECTOR OF PUBLIC WORKS

C. A. TANSILL, COMPILER

The objects of the QUARTERLY BULLETIN are:

1. To show each engineer and employee of the Bureau of Public Works the work of the Bureau as a unit.
2. To show him that his work is a unit part of the whole.
3. To make clear to every provincial and municipal official and to the people the work being done by the Bureau.
4. To make the work of the Bureau of personal interest to all.

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EMPLOYMENT OF SKILLED WORKMEN ON PUBLIC WORKS.

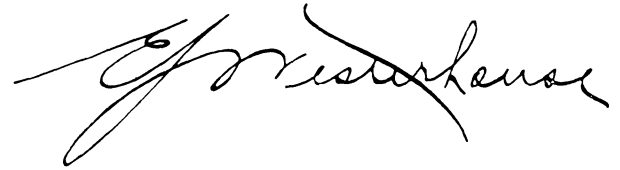
There are many engineers who incline to the view that while good Filipino clerks and bookkeepers may be had at all times, natives of education and influence are not prone to take up the more active work required in the arts and trades. To some extent this is true, as it is frequently observed that young men who might find a much larger field and more advancement in construction work prefer the office and desk work, and where field work is accepted, it is done with the hope that it will soon lead to some easier form of employment. This is so generally true that at those periods of the year when applicants for positions are most numerous it has been observed that 80 per cent of those seeking employment ask first for a position in an office; second, for a position as timekeeper, and with considerable reluctance finally agree to accept work as capataz, foreman, or a similar field position. It is evident, of course, that such applicants do not desire outside work and frequently, as a result, are not given an opportunity for such work. Often, too, appointing officers make no special effort to interest the more promising young Filipinos in this class of work, while at the same time other agencies are also at work making conditions impossible for those who venture upon an apprenticeship.

District engineers have probably found about such conditions mentioned, and now in looking over their field forces find themselves unable of taking large responsibility because the men now available are small working gangs are either those who have worked in the ranks, and consequently have the handicap of a poor education, who have been picked up by chance and, although they have failed at their chosen calling with the possibilities of advancement in their new work largely limited.

That developing Filipino foremen of ability is in reality largely a matter of careful selection and proper training can, however, be easily shown; nor is it as slow a process of development as is gen-

erally supposed. Intelligent Filipinos with standing and influence in their community, and by nature inclined to be skillful, will develop as rapidly as any other class of employee. Once given a free hand a native is capable of much larger accomplishment by reason of the fact that he is of the people he works with and thinks as they do. If any district is without promising Filipino skilled workmen it may, in many cases, be attributed to lack of effort in selecting proper material or because of the treatment accorded by agencies under which they have been employed. In one particular district, where the district engineer devoted a large part of his time in the development of Filipino skilled laborers, highly satisfactory results have obtained within the past year. Within this period a full 15-meter width of right of way has been secured for all first-class roads under the most adverse conditions. A Filipino is constructing the first-class roads in this district, which are afterwards maintained under the direct supervision of a Filipino maintenance foreman, and the engineering work is done by a Filipino junior assistant engineer under the general supervision of the district engineer. As a result of this organization, a saving of 50 per cent in supervision charges has been effected without loss of efficiency either in construction or maintenance. As a matter of fact improvement in the road maintenance has been so noticeable under this organization that it has been favorably commented upon by the general public.

The results in this district stand as concrete proof that it is entirely feasible to develop native skilled workmen for the execution of public works, and conscientious effort on organization along such lines is urged for all district engineers.



APPROPRIATIONS AND ALLOTMENTS FOR THE INSULAR FISCAL YEAR BEGINNING JULY 1, 1912.

All Insular funds available for allotment for the present Insular fiscal year have been allotted and previously reported.

LOANS FOR ROADS, BRIDGES, SCHOOLS, MUNICIPAL BUILDINGS, ETC.—SEPT. 22 TO DEC. 27, 1912.

Provinces and projects.	Acts—						Total.
	1666.	1728.	1729.	1749.	1979.	2083.	
Albay: Bridges and culverts on the Tabaco-Tiwi, Legaspi-Tabaco, Guinobatan-Jovellar and Bonga-Bacacay Roads				P34,000			P34,000
Bulacan:							
Municipal market, Paombong				3,000		P3,000	6,000
Municipal market, Obando			P3,750			3,750	7,500
Municipal market, Santa Maria			5,000			5,000	10,000
Purchase of site for proposed market building, etc., Hagonoy					P7,000		7,000
Capiz: Provincial building		P16,500	38,500				55,000
Cavite: Naic-Indang Road				50,000			50,000
Cebu:							
Municipal market, Opon				9,000		9,000	18,000
Municipal market, Barili				12,500		12,500	25,000
Ilocos Norte:							
Laoag Bridge			50,000			50,000	100,000
Roads and public improvements, Laoag		P1,000					1,000
Iloilo:							
Municipal market, Pototan				20,000		20,000	40,000
Provincial building		10,000		30,000		10,000	50,000
Misamis:							
For the purpose of constructing permanent structures			25,000			25,000	50,000
Market house, Cagayan		2,400	3,600				6,000
Oriental Negros: Siquijor-San Juan Road		7,800					7,800
Pangasinan:							
Municipal market, San Carlos				12,000			12,000
Public bath house, San Carlos				10,000			10,000
Sorsogon: Completion of municipal building, Masbate						1,000	1,000
Tarlac:							
Municipal market, Moncada				10,000		10,000	20,000
Municipal building, Camiling						10,000	10,000
Tayabas: High school building				50,000			50,000
Zambales: Central school building, San Narciso			5,000				5,000
Total	1,000	36,700	130,850	240,500	7,000	159,250	575,300

The loans stated in the foregoing table are payable as follows:

ALBAY.

For the construction and reconstruction of bridges and culverts on the Tabaco-Tiwi, Legaspi-Tabaco, Guinobatan-Jovellar and Bonga-Bacacay Roads.

Payments.	Act 1749.	
	Principal.	Interest.
First	P6,800	P1,360
Second	6,800	1,088
Third	6,800	816
Fourth	6,800	544
Fifth	6,800	272

Loan from Act 1749 bears 4 per cent interest payable quarterly.

BULACAN.

For the erection of modern market in the municipality of Obando.

Payments.	Act 1729.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P750.00	P150.00		P112.50
Second	750.00	120.00		112.50
Third	750.00	90.00		112.50
Fourth	750.00	60.00		112.50
Fifth	750.00	30.00		112.50
Sixth			P750.00	112.50
Seventh			750.00	90.00
Eighth			750.00	67.50
Ninth			750.00	45.00
Tenth			750.00	22.50

Loan from Act 1729 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the erection of modern market in the municipality of Paombong.

Payments.	Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P600	P120		P90
Second	600	96		90
Third	600	72		90
Fourth	600	48		90
Fifth	600	24		90
Sixth			P600	90
Seventh			600	72
Eighth			600	54
Ninth			600	36
Tenth			600	18

Loan from Act 1749 bears 4 per cent interest, payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the erection of modern market in the municipality of Santa Maria.

Payments.	Act 1729.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P1,000	P200		P150
Second	1,000	160		150
Third	1,000	120		150
Fourth	1,000	80		150
Fifth	1,000	40		150
Sixth			P1,000	150
Seventh			1,000	120
Eighth			1,000	90
Ninth			1,000	60
Tenth			1,000	30

Loan from Act 1729 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

The loan of P7,000 from Act 1979 to the municipality of Hagonoy for the purpose of purchasing site for the proposed market building, etc., is payable in seven equal annual installments, due in two, three, four, five, six, seven, and eight years from the date of the loan, together with interest at the rate of three per centum per annum, payable semi-annually.

CAPIZ.

For the erection of provincial building, Capiz.

Payments.	Act 1728.		Act 1729.	
	Principal.	Interest.	Principal.	Interest.
December 23, 1911	P11,000	P800		P1,320
Do	5,500	440		1,320
June 23, 1913			P5,500	110
December 23, 1913			11,000	1,320
Do			11,000	880
Do			11,000	440

Loans from Acts 1728 and 1729 bear 4 per cent interest payable quarterly.

CAVITE.

For the construction of the Naic-Indang Road.

Payments.	Act 1749.		Act 1749.	
	Principal.	Interest.	Principal.	Interest.
First				P2,000
Second				2,000
Third			P18,750	2,000
Fourth			18,750	1,250
Fifth			12,500	500

Loan from Act 1749 bears 4 per cent interest payable quarterly.

CEBU.

For the erection of modern market in the municipality of Opon.

Payments.	Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P1,800	P360		P270
Second	1,800	288		270
Third	1,800	216		270
Fourth	1,800	144		270
Fifth	1,800	72		270
Sixth			P1,800	270
Seventh			1,800	216
Eighth			1,800	162
Ninth			1,800	108
Tenth			1,800	54

Loan from Act 1749 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the erection of modern market in the municipality of Barili.

Payments.	Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P2,500	P500		P375
Second	2,500	400		375
Third	2,500	300		375
Fourth	2,500	200		375
Fifth	2,500	100		375
Sixth			P2,500	375
Seventh			2,500	300
Eighth			2,500	225
Ninth			2,500	150
Tenth			2,500	75

Loan from Act 1749 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

ILOCOS NORTE.

For the construction of Laoag Bridge.

Payments.	Act 1729.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P10,000	P2,000		P1,500
Second	10,000	1,600		1,500
Third	10,000	1,200		1,500
Fourth	10,000	800		1,500
Fifth	10,000	400		1,500
Sixth			P10,000	1,500
Seventh			10,000	1,200
Eighth			10,000	900
Ninth			10,000	600
Tenth			10,000	300

Loan from Act 1729 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the construction of roads and public improvements in the municipality of Laoag.

Payments.	Act 1666.	
	Principal.	Interest.
First	P1,000	P40

Loan from Act 1666 bears 4 per cent interest payable quarterly.

ILOILO.

For the erection of modern market in the municipality of Pototan.

Payments.	Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P4,000	P800		P600
Second	4,000	640		600
Third	4,000	480		600
Fourth	4,000	320		600
Fifth	4,000	160		600
Sixth			P4,000	600
Seventh			4,000	480
Eighth			4,000	360
Ninth			4,000	240
Tenth			4,000	120

Loan from Act 1749 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the reconstruction of provincial building, Iloilo.

Payments.	Act 1728.		Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.	Principal.	Interest.
September 8, 1912		P800		P1,200		
December 8, 1912		200				
September 8, 1913	P10,000	300		1,200		P225
Do.			P10,000	1,200		300
Do.			10,000	800		300
Do.			10,000	400		300
Do.					P10,000	300

Loans from Acts 1728 and 1749 bear interest at 4 per cent payable quarterly.

Loan from Act 2083 bears interest at 3 per cent payable quarterly.

MISAMIS.

For the purpose of constructing permanent structures on the Tinao-Bukidnon, Cagayan-Alubijid and Misamis-Oroquieta Roads.

Payments.	Act 1729.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P5,000	P1,000		P750
Second	5,000	800		750
Third	5,000	600		750
Fourth	5,000	400		750
Fifth	5,000	200		750
Sixth			P5,000	750
Seventh			5,000	600
Eighth			5,000	450
Ninth			5,000	300
Tenth			5,000	150

Loan from Act 1729 bears 4 per cent interest payable quarterly.

Loan from Act 2083 bears 3 per cent interest payable quarterly.

For the construction of market house, Cagayan.

Payments.	Act 1728.		Act 1729.	
	Principal.	Interest.	Principal.	Interest.
First	P1,200	P96		P144
Second	1,200	48		144
Third			P1,200	144
Fourth			1,200	96
Fifth			1,200	48

Loans from these Acts bear interest at 4 per cent payable quarterly.

OCCIDENTAL NEGROS.

For the construction of Siquijor-San Juan Road.

Payments.	Act 1728.	
	Principal.	Interest.
First	P3,900	P312
Second	3,900	156

Loan from Act 1728 bears 4 per cent interest payable quarterly.

PANGASINAN.

For the erection of modern market in the municipality of San Carlos.

Payments.	Act 1749.	
	Principal.	Interest.
First	P2,400	P480
Second	2,400	384
Third	2,400	288
Fourth	2,400	192
Fifth	2,400	96

Loan from Act 1749 bears 4 per cent interest payable quarterly.

For the erection of modern public bathhouse in the municipality of San Carlos.

Payments.	Act 1749.	
	Principal.	Interest.
First	P2,000	P400
Second	2,000	320
Third	2,000	240
Fourth	2,000	160
Fifth	2,000	80

Loan from Act 1749 bears 4 per cent interest payable quarterly.

SORSOGON.

For the completion of municipal building in the municipality of Masbate.

Payments.	Act 2083.	
	Principal.	Interest.
First	P200	P30
Second	200	24
Third	200	18
Fourth	200	12
Fifth	200	6

Loan from Act 2083 bears 3 per cent interest payable quarterly.

TARLAC.

For the erection of modern market in the municipality of Moncada.

Payments.	Act 1749.		Act 2083.	
	Principal.	Interest.	Principal.	Interest.
First	P2,000	P400		P30
Second	2,000	320		80
Third	2,000	240		30
Fourth	2,000	160		30
Fifth	2,000	80		30
Sixth			P2,000	80
Seventh			2,000	24
Eighth			2,000	18
Ninth			2,000	12
Tenth			2,000	6

Loan from Act 1749 bears 4 per cent interest payable quarterly

Loan from Act 2083 bears 3 per cent interest payable quarterly

For the erection of municipal building in the municipality of Camiling.

Payments.	Act 2083.	
	Principal.	Interest.
First		P300
Second		300
Third		300
Fourth		300
Fifth		300
Sixth	P5,000	300
Seventh	5,000	150

Loan from Act 2083 bears 3 per cent interest payable quarterly.

TAYABAS.

For the erection of high school building in the Province of Tayabas.

Payments.	Act 1749.	
	Principal.	Interest.
First	P10,000	P2,000
Second	10,000	1,600
Third	10,000	1,200
Fourth	10,000	800
Fifth	10,000	400

ZAMBALES.

For the erection of central school building in the municipality of San Narciso.

Payments.	Act 1729.	
	Principal.	Interest.
First	P1,000	P200
Second	1,000	160
Third	1,000	120
Fourth	1,000	80
Fifth	1,000	40

Loan from Act 1729 bears 4 per cent interest payable quarterly.

GENERAL ITEMS.

"GLIMPING THE WORLD BY MOTOR."

The following extract is taken from an account appearing in the "Japan Advertiser," Tokyo, Japan, of a tour of the world by motor made by Mr. Melvin A. Hall, of New York. Mr. Hall was accompanied at every stage of this tour by his mother, Mrs. William A. Hall.

After preliminary touring in the eastern States of America they landed with a Packard car at Southampton, and at the time this article was written the trip had covered the British Isles, the countries of Europe—including the Balkan States—Asia, the East Indies, Philippines, and Japan.

Keeping this in mind the following extracts should be of special interest to people interested in the development of the Philippine Islands.

The article, which was well illustrated by Philippine views, is quoted below:

The Philippine Islands present a different proposition to the motorist than anything else in the East, because of the comparatively recent opening of even passable overland communication. Before the advent of the American Bureau of Public Works, a matter of five or six years only, motors could not penetrate 3 miles beyond the limits of Manila and the idea of touring anywhere in the Islands was too absurd to be entertained. In the short time since 1908 fifteen hundred miles of road have been opened and maintained, and the total amount is being greatly increased annually. Those roads rated as first class are magnificent metaled highways equal to anything in the East, and the surprising ignorance of their extent and excellence, even among residents of the Islands, must be due to the fact that the best ones are not found about Manila, and because the urgent need for roads in widely separated localities does not allow of their being at once connected into a complete system.

Manila itself is a picturesque combination of an old Spanish walled town—with its narrow streets, houses with projecting second stories, open plazas and stone churches—and a modern western city adapted to the Tropics. The open Luneta, where the best orchestra in the East plays on pleasant evenings, overlooks Manila Bay, backed by Mount Mariveles and the fortified island of Corregidor, behind which the sun sets in gorgeous colors. The cool breezes which sweep across here were such a relief after the oppressive heat of Hongkong and the high temperatures of other parts of the Orient, that we wondered—as we did many times afterward—at the fixed impression which seems to prevail in the outside world, of the excessive heat in the Islands.

ACROSS THE ISLAND.

From Manila are many short and attractive runs, but the best one is across the island, past the mineral springs of Los Baños, along the large shallow Laguna de Bay, to Lucena and Atimonan. The whole trip is picturesque, winding first through cultivated land and barrios of tiny houses thatched all over with nipa palm, and then among magnificent groves of coconut palms, the most extensive in the Islands. It is 120 miles over the uncompleted Manila-South Road, which will eventually be connected with the systems of Albay and Sorsogon in southern Luzon, and the first part is a new oiled highway with a surface as perfect as anything in Europe. A few miles south of the road, unfortunately not yet approachable by motor, lies the picturesque but surely little Taal Volcano, a crater in the center of a small lake, which by a tremendous eruption in 1911 caused considerable destruction and loss of life. Beyond Los Baños one passes through San Pablo, interesting as being one of the richest towns of its size in the world, with a per capita wealth, derived from the coconut palm, of about \$1,000 gold. The last few miles are very beautiful over a steep and narrow pass with views of Tayabas Bay and the Pacific Ocean.

Owing to the lack of hotels and rest houses, extensive traveling in the Philippines would be almost impossible were it not for the generous hospitality of the American residents upon whose kindness we were wholly dependent for accommodation.

In the rugged mountains of Benguet, north of Manila, lies Baguio, the summer capital and hill station, and the approach to it by motor from the plains of Pangasinan is perhaps the finest trip in the Philippines. Pangasinan Province has a splendid system of roads, including the first metaled section in the Islands, but as yet the road from Manila is a "dry weather" one and the rainy season having already begun, we were forced to entrain to Dagupan from Aginaldo's former capital, Malolos, 30 miles out on an excellent highway. This break and a few others will soon be remedied, and when metaled and equipped with bridges the Manila-North Road to the northern extremity of Luzon should be one of the finest trunk systems in the Orient.

From Dagupan we ran through the broad rice fields of Pangasinan to Camp One at the foot of the mountains and encountered on the way some interesting experiments in temporary bridge construction. This plain is subject to heavy floods and pending the erection of expensive concrete bridges the several rivers are crossed on strong wooden ones so built that in case of a sudden rise of water the entire platform may be released at one end to swing down with the current free from its supporting piers and be hauled up on the bank to safety.

REMARKABLE MOTOR SERVICE.

With the exception of a few mountain trails the Benguet Road furnishes the sole communication with Baguio, and everything from first-class passengers to building material that enters or leaves the summer capital is carried by the most remarkable automobile service in the world. A train of high powered De Dions running on a railroad schedule, makes the return trip daily from Baguio to Camp One, connecting with the Manila trains. When, as at the time of my visit, the branch railway line to Camp One is washed out, the motors go 25 miles further to Dagupan, and back, making the round trip nearly 100 miles.

We pulled away from Camp One with our regular place in the train and ran up the narrow Bued River Cañon, while a little white tag bearing our number moved on its own wire across the huge score board in Baguio which keeps track of every vehicle on the road. The Bued River Cañon is a magnificent gorge boring into the heart of the mountain, with precipitous rocky sides along which the road is cut or suspended on bright red shelflike bridges. Sometimes we crossed the Cañon high above the river, and again descended and ran along its very edge, passing the partially interred remains of what once were steel bridges several miles above. The insignificant trickle in the cañon has often earned its title to Noer as is witnessed by further wreckage. In one place the road encircles gigantic boulders which frown where but a year ago flourished a fine little pine grove, and further up passes over a great gravel mass that caused its almost total destruction in the 1911 typhoon. Baguio means typhoon and on this particular occasion the great grandparent

of all typhoons that bred there tore down the gorge with its arms full of bridges and pieces of mountain. While the rain was falling at the rate of one and a half inches an hour one of the mountains slid off into the cañon with an heroic effort to dam the rising torrent. But a mountain stream will not be withheld for long when the rainfall is 40 inches a day: the dam broke and a 20-foot wall of water, tossing trees and boulders on its foaming crest, and half filling the cañon with gravel, polished the cliffs of the last vestige of clinging road. It was a week before the first person reached hungry Baguio on foot, so terrible was the destruction, yet four months after work was begun the motors were again zigzagging up and down with their heavy loads.

We followed after the eight-cylinder mail and passenger cars, with four-cylinder freighters trailing out behind in a long line terminated by the green flag, and passed through all the barriers with their uniformed guards at attention, for the train has the right of way. The road is divided into five blocks equipped with telephone stations and no traffic may proceed into a section until it is reported clear. Across the end of the cañon the mountains stretch sheer and forbidding and the pass rises over them into the pine heights of Baguio beyond by a series of loops and zigzags ascending a thousand feet in two and a half miles.

There the big motors, having shaken off their loads, purred away to the vast garage for a bath and rubdown after their hundred-mile run and 5,000-foot climb.

A RISKY PROPOSITION.

Baguio lies in the Mountain Province, which with its wild tribes and splendid mountain scenery offers with the somewhat similar Moro Province the greatest interest to travelers. Neither affords any motoring but are equipped with more than 1,000 miles of beautiful saddle trails. By one of these—the Naguilian trail—we returned later to Baguio, an untried feat for a motor of our size. It is the only trail at all possible for automobiles and was rather a rash experiment as the road is not designed to support such weight and frequently slides down into a thousand feet of space in sheer weariness of its precarious position. Part of it we climbed at night in the rain, and slept in a minute native grass hut awaiting the erection of a shelf of poles over a chasm where just such a thing had occurred.

Our extensive touring in the Philippines was made possible by the courtesy of the Director of Public Works. We accompanied him on long inspection trips and in this way were enabled to cover practically all the good roads in the Islands, which otherwise would have been an impossibility. From Baguio we ran to the extreme north of Luzon, following almost all the way the beautiful coast of the China Sea, where the mountains close in on the fine white road, ancient watch towers look out over the former haunts of Moro pirates, and ornamental approaches of ruined Spanish bridges unite with American concrete spans.

One other motor, a Bureau of Public Works inspection car, had made the trip to Laoag, but from a few miles north of that to Bangui, which looks toward Formosa, ours was the first and only car. The road really terminates on the edge of the hill above Bangui, for the rest is a toboggan slide of several hundred feet into a small river below. We had been warned that reaching Bangui was one thing and leaving it, another, and as that hill was the only way out it was easy to believe. However, in undaunted confidence we slid over the edge, but once at the foot and at the "end of navigation" we looked back upon our return journey with some apprehension.

I found later that the Director had not shared my confidence for there were many hombres waiting with large rocks in their hands, heavy rope, and blocks and tackle. The chute was already equipped at intervals with snubbing posts, else wheeled traffic would never leave Bangui. But the preparations were unnecessary for in spite of the tricky little ford at the foot of the ascent, and a few seconds when the wheels slipped, the car walked up with comparative ease.

This was, however, but an incident in the trip. The roads in the Ilocano provinces and some in La Union are magnificent, smooth white coral highways with clean straight edges, beautifully trimmed grassy shoulders, and countless fine culverts and bridges. The hundreds of reinforced-concrete bridges that the Bureau of Public Works have put in all over the Islands were without exception the most attractive we had seen anywhere. How great their task is may be judged by the fact that in the few sections in northern Luzon not yet taken up we crossed 56 fords and 33 bamboo ferries in 6 days.

Every town has its fine old Spanish church and convento, large picturesque stone buildings, two of which, in the Ilocano provinces, were most striking; one at Paoay with huge buttresses for protection from earthquakes, the other a great fortress-like structure on a hill above Sta. Maria. In too many of these churches the beautiful colored Spanish tiles, destroyed during the turmoil of insurrection, have unfortunately been replaced by the hideous modern roofing of rolled iron, but where the tiles still remain nothing could be more effective than these vast edifices in their open plazas.

We returned to Manila and started out on a coast-guard vessel for the other islands, the motor on a platform built up in the bow. Our course led all about the delightful interisland sea, through narrow channels between mountainous islands, up Norwegian-like fjords, and

among islets of every conceivable contour and color, we touched and toured at many places, but the most beautiful of all was Albay, with Mount Mayon rising from fields of hemp and dominating the entire peninsula. We motored completely around it and far up north over the fine roads of black volcanic rock, with the mountain always beside us. Mayon is flawless from every point of view; the most perfect cone in the world, and needs only a snow covered peak to be the most beautiful.

THE CAMINERO SYSTEM.

In Leyte Province the caminero system reaches its highest development and the result is a park-like system of roads which are absolutely perfect. The caminero is a road laborer and there is one on every kilometer of first-class road in the Philippines, whose duty it is to keep that kilometer in good condition, train the grass on the shoulders, and fill in any holes that develop. Over each ten camineros is a native capatas, and in charge of each district an American engineer. The results obtained prove it to be a wonderful system, for with such maintenance the roads do not deteriorate and no expense is encountered for reconstruction. A prize of 15,000 pesos is annually awarded to the province with the best maintained system of roads and this, to be turned into further road building, is most keenly contested for.

In Leyte the white roads stretch without a ripple, the grass which banks them looks as if trimmed with manicure scissors, the red-coated camineros salute as one passes, and the tools of each kilometer are stacked neatly by the kilometer post. But it is not mere exhibition. New villages are constantly springing up along the roads, more land is being brought under cultivation as hauling becomes cheaper and easier, and an uncared for wilderness soon assumes an appearance of prosperity and cleanliness when a well-kept macadam road penetrates it.

In Cebu we found much the same conditions and some of their roads were scenically more beautiful than Leyte because of the mountain range down the center of the island over which the roads cross with superb outlooks. But throughout the Philippines this caminero system and its interest of competition has produced such results that there is little to choose among the different provinces, and given time to connect these systems together, and somewhat better facilities in transporting automobiles among the Islands, there will be no finer opportunities for motoring in the Orient.

USE OF GREEN CARABAO HIDE FOR DIAPHRAGMS IN DIAPHRAGM PUMPS.

During the construction of bridge No. 46.4 on the Albay-Ambos Camarines Interprovincial Road, a 3 span, 5 by 4 meters structure, a great deal of trouble was experienced with the rubber diaphragms used in the pumps. The water from the excavation carried so much sand that new diaphragms were cut through in from two to four days. Canvas was used to prevent this but did not help much.

Finally the foreman in charge suggested cutting diaphragms from green carabao hide. On trial these gave very good results, lasting from six to ten days.

A hide large enough to make a dozen diaphragms cost ₱5, where those of rubber cost ₱6 each.

No preparation was given the hide before using except to soften it by soaking in water.

SUBTROPICAL RAINFALL.

[Abstract of statement on page 188, Weather Bureau Bulletin for July, 1911.]

The most striking feature of the typhoon of July 15, 1911, was the extraordinarily heavy rain which fell especially in Baguio. It seems incredible that 2,238.7 millimeters or over 88 inches should have fallen in Baguio in four days. We should have had difficulties in believing it, had we not found it thus registered by the pluviometer on the "quadruple register" as used at the first-class stations of the Weather Bureau. We do not know of any instance in which similar torrential rains have been registered in any other part of the globe.

HYDRAULIC INVESTIGATIONS.

Mr. C. W. Hubbell, chief engineer, has pointed out to all engineers the lesson to be learned from the recent developments on the Osmeña Waterworks System of Cebu. It is recalled that the design of the waterworks dam was based on a ten years' record of rainfall in which the maximum recorded was approximately 6 inches in twenty-four hours. The dam was designed to take care of this maximum at the rate of 3 inches per hour.

In the disastrous typhoon of October 14 and 15, 1912, the center of which crossed the Island of Cebu immediately north of line drawn between the towns of Cebu and Toledo, the rainfall approximated 20

inches in twenty-four hours. As a result the spillway section of the dam proved inadequate to take care of the discharge with a sufficient margin of safety. The area of the watershed for the reservoir is 6.3 square kilometers. The weir is approximately 19 meters (62 feet) long and 1.2 meters (4 feet) deep.

This experience clearly demonstrates that it is absolutely unsafe to design any structure in any part of the Philippine Islands for a rainfall of less than 24 inches in twenty-four hours and at an intensity of at least 3 inches per hour. In some sections of the Islands these figures should be increased by 50 per cent or more.

ROAD COMMITTEE AWARD.

The road prizes for the Insular fiscal year ending June 30, 1912, have been awarded by the Road Committee as shown under:

First prize.....	P15,000.	Leyte Province.
Second prize.....	10,000.	Ilocos Norte Province.
Third prize.....	5,000.	Albay Province.

1913 PHILIPPINE CARNIVAL.

The exhibit of the Bureau of Public Works at the 1913 Carnival will be a distinct improvement on the exhibits of 1911 and 1912. A separate building is to be erected on "Exhibitor's Circle," at the end of the street running southeast from the illumination tower. The location is adjacent to Calle San Luis near the entrance from that street, and very conspicuous from the tower, making it one of the best locations on the grounds.

Last year the attendance totaled nearly 200,000 of which 10,000 was within a period of two hours in the late afternoon of the closing day. This year the exhibit will be popularized more than ever and especial effort will be made to give practical object lessons which will be useful and interesting to the visitors.

Last year the Bureau of Public Works occupied a central location in the Insular building at the Philippine Exposition which was outside the Carnival grounds. The building on the Carnival grounds this year will afford about twice as much space as was occupied last year. The exhibit last year consisted of framed charts showing the operation and work of the Bureau; colored enlargements of existing public works and models of bridges, irrigation works and well rigs. This year these ideas will be enlarged upon, especially with a view to showing contrasts between the old and the new order of things.

On the front of the building will be a sign in large letters reading "Public Works" which will be visible from the tower and from all points of the amusement street between the tower and the Exhibitor's Circle.

ON THE JOB HERE AND THERE.

C. E. Gordon, division engineer, at present on leave in the States, has been commissioned to investigate and report upon concrete and verified brick and macadam road construction meeting the requirements of the heaviest truck traffic. His report will no doubt be of great interest and value in relation to the problem of permanent road construction in the Islands.

Chief Engineer C. W. Hubbell was hastily called home by cable on important business and sailed on October 25, 1912.

H. K. Morgans, formerly city engineer of Baguio and for several months acting Baguio engineer, has tendered his resignation effective October 25, 1912, through the Bureau of Insular Affairs, Washington, District of Columbia.

Levant R. Brown, assistant engineer, is in San Antonio, Texas, recuperating from an attack of pneumonia. He will return to the Islands about February 15, 1913.

G. H. Schulte, who resigned his position as district engineer of Rizal Province in April, 1912, has been heard from and his address is No. 435 Esplanade Avenue, Montreal, Canada.

A. E. Palen, district engineer of Cavite Province, who has a year's leave, is now living in Denver, Colorado, No. 1131 Washington Avenue, and is on a survey party for an irrigation company near Laramie, Wyoming.

L. W. Abrons, formerly assistant engineer, Bureau of Public Works, is assistant to the president of the Rutland Manufacturing Company, Rutland, Vermont. He is also a director in the company.

C. E. Russell, acting division engineer, fifth division, is enroute to the States with his family to spend his accrued leave.

Word has been received from the Bureau of Insular Affairs, Washington, District of Columbia, that assistant engineers C. G. Morrision and L. L. Boggess are on their way back to the Islands.

L. H. Neilsen, district engineer of Batangas Province, left November 26, 1912, to spend his accrued leave in the United States, and may be found for the next few months at Greenville, Michigan, R. F. D. No. 3.

W. M. Conway, assistant engineer, resigned December 17, 1912.

J. E. Daubenspeck, assistant engineer, left November 19, 1912, to spend his accrued leave in the United States.

C. V. Powers, district engineer of Occidental Negros, has resigned to accept an attractive offer with a private firm in the Islands.

G. O. Wagenseil, assistant engineer, has been granted an extension of his leave, owing to a death in his immediate family.

PROJECT NOTES BY DISTRICT AND DIVISION ENGINEERS.

ALBAY.

The extension to the trade school was finished in November by Pert and Mills in quite a satisfactory manner. The project consisted of the erection of a Bureau of Education standard trade school building without floor, ceiling or porch. The contract price was ₱10,250.

Work on the culverts on the Guinobatan-Jovellar Road will be finished this quarter as far as kilometer 8, the end of the present road. The culverts on the Tabaco-Tiwi Road have been started and will be completed before starting the Quinale Bridge at Malinao. This will open up the road from Tabaco to the hot springs of Tiwi.

Investigations are being made on the Island of Catanduanes for trail location by an experienced trail builder. Actual construction will probably start as soon as the rainy season is over.

A considerable amount of work has been necessary on the Legaspi-Tabaco Road through the lava beds in kilometers 4, 8, and 9 which have not been made first class on account of their proximity to the active zone of the Mayon Volcano. On October 15 a heavy fall of rain occurred and four of the temporary bridges on this section were completely swept away. The road was covered with boulders varying in size up to a cubic meter. Channels were cut where no indications of a stream were apparent before. Since that date the road has been destroyed in this section four times. In one day a bridge was put in three times and each time the water rose and swept it away. However, at no time was the road impassable for automobile traffic for more than one day.

The same trouble was experienced on kilometer 15 of the Tabaco-Ligao Road where a ford is maintained.

An additional loan of ₱34,000 for bridge construction has been granted this province, which will be used for the construction of bridges and culverts on the first-class roads from Legaspi to Tiwi and Guinobatan to Jovellar, replacing either provisional structures or old Spanish structures.

The construction of the Quinale River Bridge, with two 140-foot steel truss spans, at Malinao will commence at the close of the rainy season or in the month of March. The construction of this bridge and of a number of culverts between Malinao and Tiwi will open up a new automobile route in this province that will be used at times more than any other route, because this road ends at the famous Tiwi sulphur springs. Little is now known outside of the Bicol provinces of these salubrious springs.

AMBOS CAMARINES.

The reconstruction of 27 kilometers of the Nueva Caceres-Boundary Road is the most important project in the Province of Ambos Camarines, the road passing through six municipalities, and connecting Nueva Caceres, through the Albay Road system, with Legaspi.

It was declared first-class as follows:

September 15, 1908, kilometers 39 to 41; June 13, 1910, kilometers 1 to 19, 22 to 30, 32 to 38; June 16, 1911, kilometers 20, 21, 31, 42 to 49; December 31, 1911, kilometers 50 to 53.2.

In February and March, the road began to go to pieces very rapidly, which necessitated extensive repairs throughout and the reconstruction of kilometers 1 to 27. The failure of this section was due mainly to the original light construction which was not designed to care for the traffic which has since developed.

The surfacing was only 3 meters wide, the shoulders of various width and not standard cross section, ditches in many places of insufficient capacity, and irrigation water not properly taken care of. The surfacing material on kilometers 1 to 18 was unscreened gravel and contained a very large percentage of sand; kilometers 18 to 20, hard river gravel, but very thin; kilometers 21 to 23, very soft limestone; kilometers 24 to 27, broken stone of excellent quality, but so thin that the surfacing broke through.

The suddenness of failure was caused by the diversion of traffic from the Bicol River to the road. The steamer which runs from Nueva Caceres to Nabua was forced to tie up on account of low water

due to the prolonged drought of 1911-12. The bulk of traffic thus diverted is hemp and is hauled in carts with 3½-inch tires. Three carabaos are hitched abreast and haul loads up to 1,500 kilos.

The number of vehicles per day at this time was about seventy, almost four times the normal traffic. (Since the boat has resumed its run the number of vehicles has dropped to fifty.) Under the increased load the road began to form ruts and ravel faster than the camineros could handle it, and soon reached such a state that it was necessary to reconstruct it.

The work was started in March but had progressed only about two weeks when an accident to the road roller caused work to be suspended until June 15 when a roller was rented from the Province of Albay.

It was decided to make the reconstructed road 4 meters wide with 7-meter shoulders, to provide ditches of ample capacity and prevent their use for irrigation purposes. The 4-meter road was adopted because it has proved almost impossible to keep the 3-meter road free from ruts as the carts follow the same track; whereas on the 4-meter road it is possible to regulate the traffic so that the surface wears uniformly. Light bamboo tripods, having two legs about a meter long and one leg about 2 meters long, have been found very useful for this purpose. They are placed about 20 meters apart and shifted daily by the camineros who also remove them at night.

The reconstruction was started at kilometer 27 as stone had been delivered on kilometers 23 to 27. This section of the road is through rolling, uncultivated country which has a waxy black soil for a depth of a meter to a meter and a half. It contains a large percentage of organic matter and is a very poor roadbed. No difficulty was experienced with surface drainage; but the ground water was close to the surface and kept the road bed soft. The cost of subsurface drainage was prohibitive so the ditches were made at least a meter deep and this has answered very well by cutting off the seepage, except on kilometer 23 where it was necessary to use Telford foundation for about 500 meters.

Labor was scarce at first, but by furnishing rice at cost, no trouble was found in keeping a gang of from 150 to 200 men. They are divided roughly into three gangs. About 75 breaking stone, 50 placing stone, and 50 cleaning ditches, shaping up the shoulders, and planting grass.

An excellent quality of stone was obtained by contract for ₱1.40 to ₱1.60 per meter delivered on the road side. It consists of "nigger heads" 20 to 30 centimeters in diameter which are hard to break.

The men were worked on a task system and broke about four-tenths of a meter per day at a cost of ₱1.50. About 400 meters per kilometer were used except kilometer 23, on which 500 meters were used.

The method of surfacing was as follows: The road was first-picked up and enough stone added to fill depressions, then it was shaped up and rolled. After being thoroughly rolled the top course was spread about 8 centimeters thick and rolled, after which sand was spread as a binder. It required a great deal of rolling as the stone is very hard and has a tendency to break into slabs. Very little sprinkling was necessary as it rained almost every day.

The shoulder gang followed about two or three days behind the surfacing, widening and aligning the ditches, shaping the shoulders and sodding them with Bermuda grass. The grass is bought by contract at 20 centavos for a rice sack. It takes about a hundred and fifty sacks for each kilometer and costs about ₱60 in place.

This section was finished September 30 and the gang removed to kilometer 1. The rate of progress was one kilometer in twenty-one days and the average cost per kilometer was ₱2,450, not including surcharges.

The section of the road from kilometer 1 to kilometer 7 runs through rice land but with the exception of kilometers 1 and 2 there are no natural drainage difficulties as the road has about a one per cent slope and the water may be turned into small streams. However there are irrigation ditches along both sides and these have given trouble. It was attempted to make the road ditches useless for irrigation purposes, by building them lower than the rice paddies. Where it was necessary for an irrigation ditch to cross the road provision was made to prevent water entering the road ditches. If on a ridge most of the dikes were built across the road ditches to the right of way. The dikes were made heavy so that they could not be easily opened up and the water let into the road ditch. Where the crossing was on the slope, a small concrete trough was provided to carry the water over the road ditch. By this means it was possible to eliminate all irrigation ditches except on kilometers 5 and 6, where there is a wide deep canal on the left side of the road. This canal serves such a large area and so many different people that it was not found practicable to cut off the water, but the dams were cut down and an overflow culvert provided so that the water level will be at least one meter below the road.

It was necessary to open a gravel pit on kilometer 4 as stone could not be obtained by contract within a reasonable time and the work was urgent. A tramway 1.2 kilometers long was laid to the San Felipe River. It was practically level except for about 200 meters on the river bank which had a 2 per cent grade. One carabao hauled two cars holding seven-tenths of a meter each. The gravel was screened through a ¾-inch screen and about 50 per cent of it had to be broken after it was delivered on the road. It cost ₱1.85 at kilometer 4 and was hauled by contract for ₱1 meter for the first kilometer and adding 20 centavos for each additional kilometer. The

carts were furnished with beds holding a half meter. Two bulls or one carabao were hitched to the cart. (This does not mean that the carabao can do twice as much work as it was necessary to lay off a carabao about every third day while the bulls worked steadily.) Two hundred meters of stone were delivered on kilometer 1, four hundred on kilometer 2, three hundred on kilometer 3, four hundred on kilometer 4, and three hundred on kilometer 5. Four hundred meters were delivered by contract on kilometer 1, three hundred on kilometer 5, seven hundred on kilometer 6 and 7, at prices ranging from ₱1.40 to ₱1.70 per meter. The stone is of fair quality. It is hard and brittle, but wears evenly and binds well. It is the same stone as that obtained from the Florida quarry in Pampanga. That delivered by contract is in the shape of boulders or "nigger heads" from 15 to 30 centimeters in diameter. Breaking by hand costs 60 centavos per meter, a 3-pound hammer with a handle about 3 feet long is used and one man breaks a meter to a meter and one quarter per day. With a short handled hammer, which was used at first, one man could break only one half a meter.

The cross section and method of working are the same as described above, except that 300 meters of kilometer 1 in the poblacion of Nueva Caceres were surfaced with a 5-meter width of metaling placed in two courses.

From October 1 until December 1, 7 kilometers were resurfaced, which in spite of bad weather is an average of less than nine days per kilometer including Sundays. The average cost of this section was ₱2,255 per kilometer.

Stone has been delivered on kilometers 8 to 14 by contract and the remainder will be furnished by quarry on kilometer 19 where an excellent quality of stone is obtained. The work is progressing at the rate of 3 kilometers per month.

ANTIQUE.

The province is securing a steam pile-driving outfit from the Philippine Railway Company with a 2,000-pound hammer and 12 horsepower engine, at a total cost of ₱2,700. The outfit includes a steam pump and jet, adapting it especially to the driving of reinforced-concrete piles. The outfit is to be employed in the construction of two reinforced-concrete pile bridges on the San Jose-Dao Road. The Malamoc Bridge will consist of five 7-meter spans and the Boboc Bridge of four 7.7-meter spans. These will be the first reinforced-concrete pile bridges to be constructed in the province.

The typhoons of October 16 and November 25 wrought considerable destruction to houses and crops but did little damage to the first-class roads. Permanent bridge structures suffered no damages.

BATAAN.

With the beginning of the dry season active construction has recommenced upon the Balanga-South Road construction toward the municipality of Orion.

The estimated cost of this road for 8 kilometers length is approximately ₱45,000.

Plans are now underway for the Almario River Bridge, kilometer 21.08, and the Culis River Bridge, kilometer 21.40, of the Balanga-North Road. Concrete pile structures are best adapted for this country.

Repair work on the Balanga-North Road first-class through barrios and municipalities, was discontinued about the end of September. The use of clay dike about 50 centimeters high, well sodded, was substituted for bamboo in making gravel depositories. The depository as constructed is similar to a horseshoe in plan. It drains toward the roadway. It is more desirable than bamboo as regards economy in construction and maintenance and the ease of filling and unloading.

BATANGAS.

Survey and estimates of a road from Batangas to San Juan de Booboc were completed during the last quarter. This project when completed will develop the largest and most fertile agricultural section of the province.

The provincial board has authorized the Bureau of Public Works to advertise for bids for the construction of the Sabang Bridge on the Batangas-San Juan de Booboc Road. This bridge will consist of two reinforced-concrete arch spans, supported on cut adobe stone abutments. It is estimated to cost ₱60,000.

The construction of the Batangas-Taal Road has recommenced with the beginning of the dry season. Work has been completed to kilometer 13.

Good progress is being made on the construction of the Balayan and Lipa Market buildings. The former will be finished about March 1 and the latter early in April.

A section of first-class road 1.8 kilometers long, from the Lipa railroad station to the poblacion, will be completed by February 15. This section of road carries heavier traffic than any other section in the province and has been in very bad condition.

All concrete work on the Tanauan School building, a standard seven-room structure, has been completed.

Five good pumping wells have been driven in the municipality of Lipa and several each in Santo Tomas and Tanauan. The well rig is now operating in Bauan, where additional wells are badly needed.

The sand-clay road near Nasugbu, which was described in the October BULLETIN, has come through the rainy season in very satisfactory condition. It is being maintained under the regular caminero system.

BOHOL.

As a result of the October baguio the roads were damaged to the extent of ₱11,400. Damage to municipal property amounted to ₱2,700, and ₱1,200 to provincial property. No permanent bridge structures were injured.

The biggest project for 1913 will be the construction of the Loay Bridge. One 90-foot steel truss and a 166-foot swing plan bridge will take the place of the present bamboo ferry. The contract has been awarded to the Insular Construction Company, of Manila, to complete the sub and superstructure within four months after the receipt of structural steel.

The Tagbilaran water system has been completed. Water is pumped from a well to a 50,000-gallon tank and distributed by 1½ and 2-inch pipe lines to the different parts of the town.

BULACAN.

Work on the Hagonoy Market, Mr. S. C. Choy, contractor, has been hindered by his failure to ship tested cement. Cement has been shipped in small lots and the delay incident to securing the tests of these small shipments has resulted in rather slow construction.

Work has been begun on the Meycauayan Market, Insular Construction Company, contractors. The plans call for a market building 21 by 39.8 meters, and twenty-six tiendas, of which only eight will be built at this time.

Bids have been opened for a small market building at Obando. The successful bidder was Mr. Delmar Smith Clinton, who offered to construct this market for ₱6,600.

The Manila-North Road has been opened to Sibul Springs. After heavy rains that section of this road which lies between Maasin and San Miguel is likely to be a little muddy as it is not yet surfaced. A new wooden bridge has been built at Maasin. This will render the crossing of this river less troublesome than it has been during past seasons.

Work has been begun on the Bocaue Central School. This is to be a six-room building and will be constructed after standard plans. As no bids were received, the work will be done by administration.

Loans have been approved during the past month by the terms of which the municipality of Malolos secures sufficient funds to erect a sixteen-room school building. The new standard plan for the twenty-room building will be used, the present intention being to omit four rooms at the back until more funds shall be available.

CAGAYAN.

After some trouble and perplexity headway is now being made on the construction of a 9-meter reinforced-concrete slab-and-girder bridge on the Sanchez-Mira Claveria Road. This place is entirely inaccessible during several months of the year, a condition which in itself is largely responsible for the delays encountered. In placing the foundation 12 feet of water with a sandy formation offered unusual difficulties. Finding it impossible to keep the water down in the cofferdam with the three diaphragm pumps available the foot-valves were removed from the suction hose and the pumps used in pumping out the sand. In the absence of a diving outfit a nail keg was converted into a diving bell and the bottom of the excavation sealed up with a layer of concrete, spread over the entire area. It was then possible to pump out the water, cut off the piles, and continue with the concrete work. With the problem of foundation disposed of it is not anticipated that further difficulties will occur.

Frequent heavy rains during the last quarter have made it necessary to close down construction work on the Tuguegarao-Catagman Road. This project takes in the construction of 3.1 kilometers of first-class gravel road from the river landing to the center of the town of Tuguegarao. Work will be resumed when weather conditions permit.

Work on the extension of the present first-class road from Tuguegarao to Alcala will be undertaken about next January. It is expected to complete the road as first-class to Iguig for the present.

The Garing estero bridge, located about 20 kilometers north of Tuguegarao on the Tuguegarao-Aparri Road was completed during

the month of November at a total cost of ₱15,118. Of this amount ₱1,246 being for the construction of the approaches. The bridge is a 13-meter open-spandrel reinforced-concrete parabolic arch with a rise of 4.5 meters, estimated to cost ₱14,000, not including the footings.

CAPIZ.

Three Gabaldon school buildings, Bureau of Education plan No. 2, with outbuildings have been completed in Capiz Province at an average cost of ₱4,922 each. These buildings were constructed by administration and required five weeks' time for completion in each case.

One Gabaldon school building, Bureau of Education plan No. 3, has been completed by administration at a cost of ₱6,740. All supplies were purchased from Manila and delivered by the regular coastwise steamers to the nearest port and then transported by banca for an average distance of about 10 kilometers to the building site.

All depositories on first-class roads in the province are now being built of earth embankment and well sodded. They are semicircular in shape and are open on the road side. During the recent floods this class of depository stood remarkably well with little or no damage. These depositories will cost very little additional if constructed at the same time that the road is built.

In excavating for the new market building at Capiz, construction of which is now underway, the problem of unstable foundation as encountered in the construction of the new provincial building, again presented itself. Footings for the market building have been especially prepared and tested through actual loading. The market site is covered by flood water, hence the project is divided into two parts, drainage and fill and construction of the market proper. The drainage consists in laying 200 lineal meters of reinforced-concrete pipe 60 centimeters in diameter, and 50 lineal meters of 30-centimeters vitrified pipe. The filled area consists of approximately 44,600 square meters, and the average depth about 0.4 meter. The cost of this item has been estimated at ₱6,000.

The building is an open court type with outside dimensions of 40.5 by 28.50 meters. It is estimated to cost ₱16,400. A group of twenty tiendas, 4 by 4 meters, are to be constructed on the south and east sides of the market site at an estimated cost of ₱37,880. Work is being done by administration, and accurate cost accounts are being kept on same. In connection herewith it is of interest to note that the old provincial building constructed during Spanish times settled fully 20 centimeters during its life time. Needless to state the old building developed serious cracks and its unsafe condition necessitated the construction of the new building. The experience on these buildings again emphasizes the necessity of taking every precaution in securing a suitable foundation. The new provincial building, with its specially prepared footings, has settled less than one centimeter.

The typhoon of November 25, which passed over the central portion of Capiz Province, was the most destructive of any that the oldest inhabitants can remember. The Aclan River at some places measured 16 kilometers from bank to bank, laying waste this entire area as a result of its strong current. Fifty per cent of the buildings in the path of the typhoon were entirely destroyed and the others damaged to a more or less extent. Although the first-class roads were covered with a large amount of debris they were not rendered impassable at any point, and the damage resulting to the surface was comparatively small. Permanent bridge structures suffered no damage whatsoever. One temporary pile bridge was damaged in the amount of approximately ₱150.

CAVITE.

The road construction work from Dasmarinas to Silang has progressed rapidly since the dry season began and should be finished by March 1, 1913.

The subgrade work on the Naic-Indang Road is being carried on by a small force of men. This work cannot go ahead as rapidly as wished because of the shortage in the supply of road rollers.

The Bureau of Lands commenced work in December on the Malabon-Buena Vista Road in order to get better market facilities for the settlers on the former friar estate in that section.

CEBU.

The Atlantic, Gulf and Pacific Company have finished the Macumbucini Bridge at Panilipan, kilometer 48, on the Cebu-North Road.

About midnight December 14, thirty men armed with bolos attacked the Indian night watchman at Camp Four on the Cebu-Toledo Road. The watchman received a bad bolo cut in the side, was overpowered, and bound hand and foot. Four cases of Judson powder were taken. After carrying the powder about 2 kilometers the thieves discovered their booty was not dynamite. It was promptly dumped out where it was found the next morning and returned to the storehouse. An American foreman was attacked the next night by three men. The

foreman succeeded in securing a 14-inch dagger from one of his assailants, and there was no further display of interest in securing dynamite that night.

A new quarry has been opened up at Danao on the Cebu-North Road. The railroad company has put in a spur to hold three cars, and rock shipments have already commenced. This stone will be used wherever it can be delivered by the railroad cheaper than other stone can be secured.

The amount of damages to roads and bridges caused by the October baguio was about ₱82,000. Of this amount ₱75,850 was to roads, ₱5,000 for loss of bridge materials, and ₱2,150 damage to permanent bridges. These figures represent the actual loss suffered as compared to the original cost of the work. However, new conditions have been developed by the season's floods and the cost of reconstruction will greatly exceed the above amount.

The bent of the Talayan reinforced concrete bridge, which settled about 80 centimeters during the October flood, has been built up to proper height and is apparently as good or better than it was before.

The Cebu-Toledo Road will be reopened to wheel traffic by February 1. This road suffered to the extent of about ₱40,000 on account of the October storm.

The work of reclaiming the right of way to a 15-meter width is progressing rapidly.

ILOCOS NORTE.

In the maintenance of the second-class road from Laoag to Bangui, Nagpartian-Baruyen Hill section an interesting development occurred. The heavy grade on the north and long haul on the south prohibits the use of the ordinary surfacing materials. In prospecting for suitable material a deposit of what appears to be decomposed coral was found. This deposit was blackened and very hard on the outside where exposed to the weather, but was soft, yellowish white on the interior. A section of road was surfaced about 15 centimeters deep and 3 meters wide for observation. The material has hardened and makes a surface even more durable than coral or shell. Appearances indicate that there is unslacked lime present in the substance.

A representative of the Bureau of Science is arranging to take a sample to Manila for testing.

Women and girls are employed on road construction and even on bridge work as laborers in this province. In the construction of the Paoay-Currimao Road it is recalled that at one time there were approximately 500 women and girls employed daily. These feminine workers, receiving from 20 to 25 or 35 centavos per day, according to their strength and ability, are most efficient when materials for subgrade, surfacing, or gravel and sand for concrete are to be carried a short distance. They tie up their skirt or "pandling" to be less hampered as they work and wield shovels, load, carry and empty their baskets with a zeal that outclasses the men. In the construction of subgrade, Paoay-Currimao Road, it was necessary to haul material about one-half kilometer at one point. This was accomplished with women workers. Men loaded the baskets at the borrow-pits. Baskets hold about one-sixtieth cubic meter and are carried on the head. On a short haul a woman will carry from a meter to a meter and a half of material per day. As may be imagined there is considerable talking done as the work progresses, especially in the afternoon, when the women begin to tire. Ignorance of the dialect may have caused the listener to misinterpret, but it is said that the capataces (men) use some very forcible arguments to convince the ladies that they should talk less and work more.

On concrete work women are used to advantage carrying sand, gravel and water. They are not strong enough to mix concrete for any length of time, so men are employed for that purpose. The "material" gang, having filled the barrels for the next batch, are used to pass the mixed concrete to the forms, in buckets. Later, the forms having been stripped and the concrete rubbed-down, a couple of women suffice to carry water and keep the green concrete wet down.

On the Laoag-Bangui Road, north of Pasuquin, a stretch of road which was formerly a torment to motor cyclists and a "horse-killer," because of loose sand, has been placed in good condition by spreading a thin layer of clayey soil over the sand. The two combined form a good surface for light traffic.

Several dirt-gravel depositories built for experiment and observation before the last rainy season have justified the small initial cost of their construction by the manner in which they "stood-up" under the rains. These depositories were merely enlargements of the shoulder of the road, comparatively long and narrow where physical conditions required, or circular in the flat country, with well-sodded slopes. In place of the usual "dike," or embankment to contain the gravel, a flat sodded shoulder approximately 40 centimeters wide was constructed and the depository was filled only enough to bring the foot of slope, at its natural inclination within the inside of the shoulder. Obviously, this type of depository will not serve where the road is swept by frequent floods, but for ordinary conditions it has served very well in this province.

The BULLETIN has been the subject of much favorable comment in both official and civil circles.

ILOCOS SUR.

Formal acceptance has been requested for two school buildings which were completed during the quarter. A No. 3 building was completed at Santiago at a total cost of ₱7,072.25; a No. 2 building was completed for the barrio of Salcedo, Santa Lucia, at a total cost of ₱5,057.98.

The condition of the sections of second-class road during the last rainy season emphasizes the necessity for constructing as first class the entire road from the southern boundary at Tagudin to the northern boundary of Ilocos Norte. The unimproved sections of this road at times were almost impassable for any kind of vehicle traffic. The members of the Philippine Assembly from the Ilocos provinces have introduced a bill appropriating sufficient funds for the completion of all sections of road as first class from the end of the road in La Union Province to Laoag, in Ilocos Norte Province. This construction will meet one of the greatest economic needs of the Islands, and the bill should receive favorable consideration at the hands of the Philippine Legislature.

All first-class roads in the province are being maintained in excellent condition. The maintenance cost for the provincial fiscal year ending December 31, 1912, will approximate an average of ₱255 per kilometer.

ILOILO.

The district engineer of Iloilo is taking steps to open a stone quarry on the Island of Guimaras, some 15 kilometers from Iloilo. The soft grade of gravel available in Iloilo is entirely unsuited for surfacing the city streets. Besides being very unsatisfactory, it has likewise proven very costly. The stone proposed for future use is a dark colored basalt, showing a test percentage of wear of 1.69, French coefficient, 23.7, cementation fair. Considerably better roads at a saving of cost are expected from the use of this material.

Construction work on the Jaro River Bridge, a two-span steel truss of 39.62 meters each, of concrete substructure, was started on November 1 by the Insular Construction Company. The contractors are having a switch laid from the Philippine Railway to the bridge site. They propose driving foundation piles for abutments and piers with the railway portable pile driver, carrying track across the river on false work. By doing this it is estimated that considerable saving will be had in both time and cost.

ISABELA.

Work on the Ilagan central barrio school, a No. 10 plan, is making good progress. The project is over 60 per cent completed.

The first-class road from Echague to Carig is being maintained in excellent condition. A red volcanic earth and gravel conglomerate is used as a binder giving a uniformly even surface effect.

Bids will be opened in January for the 160-foot steel superstructure for the Rugao Bridge. All materials and supplies for the substructure have been requisitioned from the Bureau of Supply.

LAGUNA.

It will be of interest to know that the maximum grade between Calauan and San Pablo is 13.5 per cent. This is limited, however, to short sections of 20 meters each. The highest elevation above sea level on this road is reached at what is known as the Imoc Hill with an elevation of 160.5 meters.

During the last quarter the most important construction work has been the resurfacing of the road from San Pedro Tunasan, kilometer 32, Manila-South Road, to kilometer 46, in Cabuyao. This stretch was formerly a heartbreaking one to automobile owners and lovers of joy rides.

Another important construction has been the temporary bridge over the San Cristobal River at kilometer 53, Manila-South Road.

Between San Pablo and the Tayabas boundary there is a section of road one kilometer in length that is rapidly getting its quota of broken stone preparatory to a first-class declaration. This section is passable, however, at all times.

The pretty example of adobe masonry arch, constructed during Spanish régime, to mark the north entrance to the municipality of Santa Rosa, kilometer 41, Manila-South Road, is about to be repaired to its former lines in order to preserve one of the few remaining structures of this type for future generations.

The work of constructing the new electric light plant in San Pablo is going rapidly ahead, most of the concrete posts for the distribution line are now in place.

LA UNION.

All first-class roads throughout the province have been maintained in an excellent condition. A collapsible deck bridge is being constructed for the Bauang River crossing and when completed will open the entire north road through the province from the end of the railroad to the Amburayan River to automobile traffic without inter-

ruption. The four streams between San Fernando and Bangar are crossed with ferries which in no case causes a delay exceeding twenty minutes time. The officials of the subprovince of Amburayan are arranging to maintain the mountain province section in a passable condition during the entire season. This will make it possible to go from the end of the railroad at Bauang to the town of Laoag in Ilocos Norte without interruption or serious delay at any time.

The construction of the cart road from Naguilian to Ripsuan has been completed in so far as present funds will permit. The road is now passable for vehicles at all seasons of the year and is easily passable for automobiles under its present conditions during the dry season. With an additional allotment of approximately ₱10,000 this entire road can be converted into a first-class section with hard and durable surfacing.

A collapsible deck bridge is in course of construction for the Naguilian River crossing which will further facilitate traffic on this road.

The harvesting of an unprecedented rice crop has seriously affected the supply of labor. Road construction, however, continues without interruption on the Bauang-Caba and Balaoang-Bangar Roads. Five kilometers of subgrade have been completed within the last quarter on these projects. Practically all subgrade work is let out to contract at a uniform rate of ₱1 per linear meter. This unit cost covers the clearing of right of way, completion of subgrade to grade after rolling and finished slopes including sodding. This unit price is paid where the amount of embankment approximates from 2 to 3 cubic meters per linear meter of subgrade. These contracts are let out in small job lots to the natives living in the vicinity of the road. Under this plan the entire supervision required is but one foreman and one capataz. This same plan was adopted in the construction of the Naguilian-Ripsuan cart road, proving both economical and expeditious.

A presidencia building has been completed for the municipality of San Fernando, having been under construction for a period of three years. This was in accordance with the original plan which contemplated that the funds available in the beginning would permit of sufficient work on the structure to place it in a habitable condition. The building was therefore occupied by the municipal government and each succeeding year such additional funds provided for the continuation of the work as the municipal finances would permit. The result is that the municipality has had the use of this building for two years, even though incomplete, with the building now entirely completed. The first story is of masonry and the second of native hardwood. The building is well finished, neat, and very attractive. The municipal council of San Fernando deserves special credit for the persistent efforts with which work was continued from time to time and finally completed without the necessity of incurring any indebtedness whatsoever. It required an economical business administration such as few municipalities can boast of. The complete cost of the building is ₱14,330.

LEYTE.

In the extension of the first-class road system of this province the section of road being built is that from Burauan to Dulag, a distance of 16 kilometers, the latter town being on the coast. This road has a well-deserved reputation of being one continuous mudhole in the rainy seasons for over half of its length, and in places the hole seems without bottom. This condition generally extends well into the dry season. It is proposed to complete this project during the coming dry season and in order to be able to push the work without any delays the following order of procedure was adopted:

- (1) From September 1 (immediately after the collection period) until the rains interfered, grading was pushed as fast as possible.
- (2) All completed grading was fenced in and no traffic allowed on it.
- (3) Division drains were constructed everywhere possible for taking the water from the road as fast as it falls.
- (4) The places which ordinarily developed into mudholes were filled with large boulders or suali mats and then covered with earth and so ditched that the water can drain from the very bottom of the mudhole. These places were then fenced in so that no traffic might disturb them. It is expected that when the dry season actually begins the road will assume a condition capable of being worked and that the entire road can be completed prior to the beginning of the next rainy season. This road is unique in the fact that it has no bridges and only one culvert and a few drain boxes.

The typhoon of November 24 which passed over the Province of Leyte was the most severe of any that the oldest inhabitants can remember. The damage suffered by the Tacloban-Carigara Road, 54 kilometers in length, is estimated at ₱12,725. For the most part this represents loss of binder washed out of the surfacing and for various short sections the loss of a part of the metaling itself. The damage to temporary bridges and approaches on this road is estimated at ₱4,400. Permanent structures suffered no damage whatsoever.

Similar damages to the Palo-Dagami Road are estimated at ₱8,850 with the damages to temporary structures estimated at ₱1,280.

The total damage to roads and bridges in the province is consequently estimated at ₱27,255, including damages to temporary structures and approaches. No damage was done to any of the permanent structures.

The same typhoon damaged public buildings in an amount estimated at ₱39,000. This includes the old provincial frame building, provincial high school, trade school, oil, and two dormitory buildings. A close study of the various features of building construction indicates the necessity for a number of modifications in designing. Purlins should be halved together horizontally and bolted to the rafters at every joint, with 3-inch bolts. In addition to these bolts all lower purlins should be securely strapped to the rafters with two twisted iron straps, 1 by 1-inch. In fastening the iron roofing the number of galvanized-iron straps should be increased using a heavier iron and of additional width. In practically every case the iron roofing was separated from the purlins by tearing off the galvanized-iron strap at the rivet section. As a result of the observations made in this case the Consulting Architect is contemplating a modification of all plans and specifications to meet the requirements for resisting the ravages of the most severe typhoons.

MISAMIS.

The reconstruction of the Aloran Central School has been completed. Work consisted of putting in new doors, windows, partitions, and galvanized-iron roof.

A bodega has been constructed of galvanized-iron on apitong frame at the Cagayan dock.

The 2½ kilometers of the Cagayan dock, first-class road is being resurfaced; estimated cost ₱6,000.

Shipments of construction materials have been greatly delayed owing to the loss of several coasting steamers at Cebu during the typhoon of October 15.

The work of clearing roads of encroachments is making steady progress and it is believed that by July 1, 1913, all obstructions will have been removed except a few buildings of permanent construction. So far very little trouble has been encountered from the property owners. In the municipality of Cagayan the district engineer has been greatly assisted by the presidente.

NUEVA ECIIJA.

Under a large force of men the new subgrade work on the Manila-North Road has commenced at both Baluarte and Santa Rosa on the section from the Bulacan boundary to Cabanatuan.

On the northern section of the Manila-North Road the subgrade is almost into San Juan de Guimba, and good progress is being made on the foundation work for the Baliuag River Bridge located on this road between Baloc and San Juan de Guimba.

OCCIDENTAL NEGROS.

The baguio of October 16 and 17 was very destructive in Occidental Negros, doing a great amount of damage both to public works and private interests. The effect on the cost of future road and bridge work will probably far exceed the damages done by the storm, in that a new high-water mark has been established over the entire province. In places this mark has been raised 4.1 meters above those previously recorded. To meet this changed condition will mean a great increase in cost of proposed work.

A severe test was given the three reinforced-concrete bridges recently completed in Occidental Negros. On the Imbang Bridge, a 2-span reinforced-concrete arch bridge, of 25 meters each, the flood waters completely filled the arches and several hundred logs became jammed above the bridge, causing the water to overflow the surrounding country. One log some 3 feet in diameter was lodged in one of the small spandrel arches and was not removed until the flood had subsided. The jam remained in place some three days before same could be removed. No damage was done to the bridge except that the water scoured out the foundation around the north abutment to the top of the foundation piles, and cut into the clay bank on the north side of the river some 25 feet. While no damage was done to the bridge, protection work must be constructed on the north side of the river and riprap will be required around the north abutment. The second bridge was the Matabang Bridge, a 2-span reinforced-concrete arch bridge of 21 meters each. Here a jamb of bamboo raised the water, and in order to relieve the strain on the bridge, the two approaches to the bridge were cut. The water subsided without any damage to the bridge. On the Tanalao Bridge, a reinforced-concrete slab-and-girder bridge, four spans of 12 meters each, between Hinigaran and Binalbagan, the water raised one meter above the balustrades. The north approach of the bridge was washed out, but no damage done to the bridge itself. Strange to relate, this is a tidal stream and the bridge is located not over one kilometer from the ocean. It would seem scarcely possible that the water should raise to this elevation above the ocean, the elevation reached being

5.4 meters above low tide, an increase of 4.1 meters in this elevation of flood water.

A preliminary survey and estimate has been completed for an interprovincial road to connect the west and east coasts of Negros between San Enrique and Valle Hermoso. The 7 kilometers of first-class road already constructed from San Enrique to La Carlota will be utilized. Two routes of approximately the same length have been investigated for the portion of the road between La Carlota and the Tabacalera Hacienda Itaas, one via the Government experimental farm at La Granja and the other via Antipolo and la Castellana. The latter is estimated to be the cheaper by ₱66,000, although if selected as the final location it will necessitate the construction of 9 additional kilometers of road as a separate project to connect La Carlota and La Granja. The estimate for this separate project, including ₱36,500 for the Najalin Bridge which would probably be omitted, is ₱84,720, making the total cost of both the interprovincial road and the La Granja Road only a little more than the one project for the interprovincial road via La Granja. The Antipolo-La Castellana route is 68 kilometers in length and, first-class with structures, is estimated to cost ₱1,152,000.

In addition to developing about 70,000 hectares of rice and sugar land and furnishing an outlet for two stretches of forest approximating 8 kilometers in width, this road will furnish a means of quick transportation between the east and west coasts of the island, lack of which has always divided it into the Occidental and Oriental Provinces. The route passes the foot of Canlaon Volcano and crosses the island with a maximum elevation of 480 meters.

Over 15 kilometers of the most difficult portion of the route has already been constructed to accommodate cart traffic. The total expense of locating and constructing this road was born by Don Diego de la Viña, of Valle Hermoso, who has already begun the development of his large tract of rice land on the headwaters of the Binalbagan River. Although in order to reduce the grades this road will have to be relocated in some places it is notable for being probably the largest private project of this nature undertaken in the Islands.

ORIENTAL NEGROS.

A survey and estimate has just been completed for that section of the Dumaguete-North Road lying between kilometers 18 and 51. This, though but a small part of the above-named road, with the already completed section, connects the five wealthiest municipalities in this province and has always been conceded to be the road project most deserving of attention here. With the idea of putting this road in continuously passable condition, ever since the American occupation, money has been regularly appropriated whenever it was available.

Because of the comparative poverty of many of the intervening sections and because of the ease and cheapness of water transportation along the coast, road construction did not flourish especially in this province during the previous years.

The result was that the present Government began with an almost original field. This has had its advantages as well as disadvantages. One of the greatest of the latter is that this province, though exerting herself to the limit, has only now reached the place where she has enough streams bridged to begin building a little road. One advantage is that hardly without an exception her bridges are new and well located and of good construction. Another advantage is that old and crooked lines of travel, having had very little work done on them, can be easily abandoned, and, since with the lack of development land values are low, new right of way can be readily secured at low cost. The result is that a well aligned road with easy grades is being constructed at a comparatively low cost.

The attitude of the people along the route of the road is especially to be admired. Their willingness to give up land and permit their houses to be moved to facilitate the construction of the best possible road in the best location and with all the right of way necessary is very general. Because of this all those connected in any way with road-building in the province are interested in their work and take pleasure in building roads that the people can appreciate and point to with pride.

Some interesting work has been done lately in the matter of road surfacing. Because the roads in this province almost invariably follow the general direction of the coast it is readily seen that they pass through extremely varied country. This brings opportunities to use almost every class of surfacing material from the softest marl through "anapog," coral, and stream gravel to the hardest of broken stone.

At present construction is being carried on along a section of coast-line where headlands of "guiso" alternate with bays and inlets each with its beach of sand or coral. The quality of these materials varies greatly from place to place and sometimes within a few feet great differences occur. Some deposits of coral, used because nearest at hand, bind easily under the roller, and even under light wheel traffic, while that taken from the same beach but a short distance away, though to the eye apparently the same, requires an extraordinary amount of rolling. These difficulties have been met by mixing in various proportions guiso from the hills with coral from the beach, and judging from the way it binds which mixture works best for each class of material. This necessitates frequent changes but the

result is a fairly uniform quality of road and one that looks very neat and appears to be durable.

Several of the typhoons which have caused such great damage in the Visayas have left Oriental Negros unscathed with but slight damage to public works. However, the storm of November 28 passed directly over Dumaguete and while most buildings were unaffected by the wind, the torrents of rain that evidently fell in the mountains back from the coast caused a rise in all the rivers of this region that has not been equaled in years. Sections of road that had never before overflowed were under water for great distances and some damage was suffered by downstream shoulders of some parts of the roads where the slopes have never been sodded.

The greatest damage however, was the loss of the Ocoy Bridge. This was a reinforced-concrete arch structure of three spans located in kilometer 9 of the Dumaguete-North Road, which cost ₱19,950. It was constructed by contract in 1909. The stream, though easily forded during normal stages, is subject to rapid rises and has a steep fall both above and below the bridge, although this is within a few hundred meters of the sea. Apparently drift consisting mainly of bamboo collected above the bridge giving the water some head had causing it to scour beneath one of the channel piers. When this went the whole structure followed.

PAMPANGA.

The maintenance work on the San Fernando-Lubao Road has been much bettered during the last quarter. The sodding of the side slopes of the road is a great improvement to its general appearance.

The road between Lubao and Florida de Blanca has been reopened to traffic and it will soon be possible to go by automobile into Tarlac by this route.

The three-span steel bridge about 5 kilometers out of Angeles on the Angeles-Porac Road was finished in December by the contractors, the Atlanta, Gulf, and Pacific Company.

The concrete piles for the two slab-and-girder bridges on the Manila-Tarlac Road between Calumpit and San Fernando were completed in December and the actual construction of the bridges will begin at once.

PANGASINAN.

Maintenance of all first-class roads of the province has continuously improved during the past quarter. Earth depositories have been completed on all sections except where permanent depositories had been previously constructed. The general appearance of all first-class roads is excellent.

All second-class roads are in good condition, receiving careful supervision from a foreman especially assigned to this work familiarizing himself with the needs of the various sections of the road through close observation both during the wet and dry season. This permits him to anticipate the amount of work required and materials necessary for any particular section. Under this method maintenance material is deposited during the dry season at a low unit cost and is then on hand for use during the wet season.

Owing to an exceptional rice harvest scarcity of labor and transportation is interfering with the progress of work on all contract bridges.

Subgrade work by administration on the Villasis-Urdaneta-Binalonan Road has been economically prosecuted through an efficient system under which each laborer moving dirt employs a wheelbarrow, pick, and shovel, thereby working independent of any other laborer. This is in contrast to the organization ordinarily used whereby one laborer handles the wheelbarrow, one man the pick and the other the shovel, which at all times proves expensive by reason of the lost motion.

The Hermosa dike is being constructed under contract in accordance with plans and specifications prepared by the irrigation division. The total cost of the project is estimated at approximately ₱40,000. The work is being done under the direct supervision of the district engineer.

Plans are in the course of preparation for a collapsible deck bridge across the Agno River at Carmon on the Rosales-Binalonan Road. Since the advent of the railroad, Rosales has become an important commercial center as a result of which an enormous amount of traffic is developing on this road, making the bridge project specially important.

RIZAL.

Funds have been made available for the construction of the Antipolo Road. The subgrade has been completed and surfacing started, with an expenditure to date of approximately ₱25,000. It is anticipated that the road will be completed during February, 1913.

The contract for the construction of the Nanca Bridge has been awarded to the Atlantic, Gulf and Pacific Company. Work was started in December.

The oiling of kilometers 3 to 12 of the Manila-South Road has been taken up. The results so far have been very good.

The road connecting the Manila Golf Club with the Manila-North Road has been completed, with a 4-meter width of surfacing and 15-meter right of way, a total cost of ₱2,450.

The oiled section of the Manila-South Road over which the auto truck efficiency test recently held by the Bureau of Public Works was run, developed no flaws or abrasions under the rather severe loads to which the road was subjected. On several sections of the road, however, the surface broke through under an overloaded steel-tired truck employed in the transportation of farm products.

SAMAR.

The Calbayog-South Road is nearing completion. Considerable trouble has been experienced during the entire period of this work in securing labor. Recently, at times, it has been necessary to almost suspend operations entirely for lack of labor. The high price of hemp was largely responsible for this condition earlier in the season, but during the past two months the rainy season has made steady work impossible and such labor as was procurable could work but part of the time. As many of the laborers come from a distance and camp along the work, they were scarcely able to earn sufficient for their subsistence, so naturally preferred to loaf at their homes where their living expenses were much less. During the coming year it is expected to extend this road north from Calbayog in connection with the scheme of ultimately securing land routes to the northern part of Samar where the topography of the country gives peculiar advantages for the development of a combined water and land system of communication reaching the greatest production areas with the least expenditure.

The damage caused by the recent typhoon was confined mostly to points south of Catbalogan on the west coast and south of Borongan on the east coast. The only damage to public works in the province was on the east coast. Two small temporary pile bridges on kilometer 17 were destroyed and some slight damage done to the stone causeway at this point. The total damage will not exceed ₱2,000.

It is planned to start work on the trail from Guianan to Salcedo immediately, largely as a relief measure. The damage in this locality was very great; in many sections the destruction of the coconut trees being complete.

Tenders were recently requested for the construction of a municipal school at Catbalogan.

SORSOGON.

Two artesian wells drilled in the town of Sorsogon to a depth of approximately 200 feet are each flowing from 25 to 30 gallons per minute. The water in both cases is excellent. A third well will be immediately undertaken.

A third passenger automobile has been installed and is running on a regular schedule between Sorsogon and the towns of Bacon, Guinajan, and Abuyog. A touring car is also available for special trips.

Two new school buildings have been completed during the quarter, one at Juban and the other at Magallanes. The first is a No. 6 plan building and cost complete approximately ₱11,100. The other is a No. 3 plan building costing approximately ₱6,100.

Work has been started on the Gubat end of the Sorsogon-South Road. Work on the Sorsogon end has been in progress for some time and only a short intervening section remains to be graded. All culvert and bridge work on this road has been completed.

Work which had been suspended on the Pawic River Bridge for want of labor has now been resumed. Labor continues to remain very scarce and it may be some time before this bridge is actually completed. The design calls for an 18-meter concrete arch which is being constructed by administration. The towns of Irocin and Bulan, with a combined population of approximately 23,000, are unable to supply the required number of laborers for the completion of this structure, which is urgently needed by the planters themselves.

On Friday, November 8, the town of Sorsogon suffered severely from an earthquake that lasted fully thirty seconds. The high school building, a structure of concrete blocks, and the central school building, Bureau of Education plan No. 10, although developing a number of cracks neither building was seriously damaged. In the residence section of the town several walls collapsed and a great amount of damage to property resulted. Fortunately no lives were lost. The Constabulary barracks, an old Spanish stone building, was very seriously damaged, in fact to such an extent that it became necessary to vacate the building. None of the concrete bridges and culverts in the province was damaged.

The increased price in hemp has seriously affected the supply of labor and transportation in the execution of public works. It is at present impossible to secure the required number of laborers even at an advanced wage rate. On the Sorsogon-Gubat Road where there has been previously employed some 500 or 600 men are now employed,

although the rate of pay has been increased to 70 centavos per day. Transportation which was previously available at ₱1 per day cannot now be had at any figure. On the delivery of surfacing material for the road the unit cost is now three or four times the previous cost.

SURIGAO.

The severe typhoon of October 14, 15, and 16 did very little damage to the road construction proper in Surigao. The saddest loss was the avenue of pretty acacia trees with their burdens of orchids and tree ferns that shaded the road from Bilangbilang, the port of Surigao, to the town center. This magnificent avenue is only a thing of memory.

Because of the scarcity of labor, which is due to the high price of hemp with which Surigao abounds, the heavy trees that formed a barrier to all traffic were removed by hauling with a road roller.

The Placer-Mainit Road is now open for traffic over the coastal range to the inland plateau that leads to Lake Mainit.

As the rainy season in Surigao begins with the month of November and amounts to nearly 150 inches a year, all construction work on the roads has been abandoned until March, 1913.

TARLAC.

Five automobiles are now regularly carrying passengers between Tarlac and Victoria, over the recently completed first-class road, at the rate of ₱1 each way. The distance from the railroad station at Tarlac to the presidencia at Victoria is 14 kilometers.

Construction was begun in November on the Tarlac-Gerona Road, which when completed will be a first-class gravel surfaced road 12 kilometers long. Sections aggregating a total of 800 lineal meters will be treated with asphalt as a protection against scour from the floods of the Tarlac River.

The construction of the provincial prison, Insular Construction Company, contractor, is progressing slowly on account of the difficulty in securing cement. The contract time will expire January 4, 1913, whereas the building will be only about 40 per cent complete.

A contract has been let to Mr. W. J. Odom for the construction of three concrete slab-and-girder bridges on the Tarlac-Gerona and the Tarlac-Capas Roads. Two of these bridges consist each of two 7-meter spans, the other of three 7-meter spans. The contract price is ₱16,800.

A Bureau of Education standard plan No. 2 schoolhouse has been completed in a barrio of Tarlac at a cost of ₱4,278.14. The length of haul for supplies was 3½ kilometers over a third-class road.

Four Bureau of Education standard plan No. 1 schoolhouses have been completed in the barrios of Camiling at an average cost of approximately ₱2,300, including estimated value of materials and transportation donated. The average haul for supplies was 7 kilometers on river, and 20 kilometers over third-class road and trails.

TAYABAS.

Work has been started on the Lucena central and Morong barrio schools. The Lucena building will conform to a No. 10 plan with ₱30,000 available for the project. The Morong building will conform to a No. 2 plan with ₱4,600 available. Both are administration projects.

The limited supply of laborers in the province has caused the district engineer to negotiate for the immigration of laborers from the provinces of Ilocos Norte and Ilocos Sur.

Mr. A. F. Allen has started work on his contract for the construction of three reinforced-concrete bridges on the Atimonan-Gumaca Road. These bridges will have a total span of 87 meters. Two of the structures will be of reinforced-concrete pile bents, the first of this type to be constructed in the province.

The Government is recovering its full right of way width on public highways through the employment of a right of way agent. Judging by the progress being made it is believed the entire work will have been accomplished within another year. The provincial governor is lending his hearty support to this as well as other public works measures.

Excellent progress is being made on the resurfacing of the road from Sariaya to Candelaria. The alignment of the road through the town of Sariaya has been very materially improved by cutting through the churchyard, property of the Catholic Church.

ZAMBALES.

The provincial budget for the new fiscal year beginning January 1, 1913, provides ₱12,500 for the construction of permanent bridges between Subic and Iba. This will replace the only wooden structures remaining on this road.

The construction of a wooden pile bridge, 125 meters long, has recently been completed by administration, at a total cost of ₱1,850.98. This bridge connects the town proper with its principal barrio Calapandayan. Boats discharge their cargo on the beach at Calapandayan which makes the bridge of special value in getting supplies into the town of Subic. The military authorities attached sufficient importance to this project to offer the use of their steam pile-driver without cost to the province for the driving of the piles.

A number of recent attempts to secure artesian well water for the town of Subic have met with failure. The district engineer, as a result, made a number of preliminary investigations for the purpose of securing a gravity water supply. A little over one kilometer distant from the center of the town water may be secured from a mountain spring. Water is now being obtained from this spring at a cost of from 5 centavos to 12½ centavos per 5-gallon oil can or at a minimum price of approximately ₱2.80 per cubic meter. The proposed water system, using 4-inch and 3-inch main pipe line with a 2-inch and 1-inch galvanized-iron distribution pipe line should result in a cost not to exceed ₱10,000. This spring flows 0.38 second foot and should supply the city all the water required, if the system is properly metered. Attempts to secure artesian water in the town of Olongapo have failed even where the well was driven to a depth of 2,000 feet. The conditions at Subic being very similar, it is not thought likely that a successful artesian well can be driven in its vicinity.

In the town of San Narciso three artesian wells have been driven, in each case securing a flow of water which, however, is not suitable for domestic purposes. A deep-well rig has not been tried out at this place.

MAINTENANCE OF FIRST-CLASS ROADS IN THE PHILIPPINE ISLANDS.

B. VON SCHMELING.

[See title-page for a view of an effectively maintained road, Province of Leyte.]

Macadamized roads cannot withstand weather conditions and traffic wear without systematic maintenance and the repair of all small and large injuries to the road. Much has been written and said about the importance of the maintenance of macadamized roads; this article will merely deal with maintenance systems and the work required from maintenance organizations in the Philippine Islands.

1. Macadamized roads, well constructed, must always be preserved in first-class condition, meeting all requirements that the weather conditions and each special class of traffic make.

2. The cost of maintenance must be reduced to the lowest figure consistent with the fulfillment of all requirements.

How can this be accomplished?

Through organizations that systematically battle with all the elements of destruction, heal original defects, caused through faulty construction which develop after the road has been opened to traffic, heal all injuries caused by the common foes of macadamized roads, demand the respect of all users benefited by the road and that practice true economy in all matters affecting the cost of maintenance work.

There is no more important duty resting with the civic bodies, the Insular, provincial, and municipal governments, than the maintenance of existing roads affecting the welfare of the communities in numerous ways. The full realization of the importance of the maintenance of roads by district engineers and all their subordinates, by the provincial and Insular authorities and by all persons benefiting from the existence of the roads, will create a spirit of coöperation essential to effective maintenance work. Interest in this work by only some of the aforementioned groups is not sufficient; all must work coöperatively and must realize the value of this work. The district engineer who is trained for such work and who has made a thorough study of economy therein is the qualified authority to supervise this work and to educate all concerned to realize that the maintenance of existing roads is more important than the continuation of new construction where same has to be undertaken at a sacrifice to the maintenance work. In order to demonstrate the importance of giving the maintenance of first-class roads preference over all new work, from a purely business standpoint, a tabulation like the following will do much to establish a clear conception of the difference of a sane business method as against the speculative usage of the funds of the province.

The following tabulation shows a province under "A" as funds should be applied and under "B" as they should not be applied:

PROVINCIAL BUDGET—1912.

"A."

Kilometers first-class road "70".

Income:	
Fiscal year 1912	₱140,000
Expenditures:	
Maintenance first-class roads, 70 kilometers, at ₱600	42,000
Maintenance equipment	5,000
New construction	93,000
Total	140,000

"B."

Kilometers first-class road "70".

Income:	
Fiscal year 1912	₱140,000
Expenditures:	
Maintenance first-class roads, 70 kilometers, at ₱350	24,500
Maintenance equipment	2,000
New construction	113,500
Total	140,000

PROVINCIAL BUDGET—1913.

"A."

Kilometers first-class road "85".

Income:	
Fiscal year 1913	₱140,000
Expenditures:	
Maintenance first-class roads, 83 kilometers, at ₱550	45,650
Maintenance equipment	5,000
New construction	89,350
Total	140,000

"B."

Kilometers first-class road "86".

Income:	
Fiscal year 1913	₱140,000
Expenditures:	
Maintenance first-class roads, 86 kilometers, at ₱350	30,100
Maintenance equipment	2,000
New construction	107,900
Total	140,000

PROVINCIAL BUDGET—1914.

"A."

Kilometers first-class road "92."

Income:	
Fiscal year 1914	₱150,000
Expenditures:	
Maintenance first-class roads, 92 kilometers, at ₱500	46,000
Maintenance equipment	5,000
New construction	99,000
Total	150,000

"B."

Kilometers first-class road "101."

Income:	
Fiscal year 1914	₱150,000
Expenditures:	
Reconstruction first-class road: 86 kilometers, at ₱1,400; 15 kilometers, at ₱500	127,000
Repair and replacing equipment: 2 road rollers; 2 engines; 1 crusher; 30 tram cars	12,000
Replacing three-I-beam bridges: not having been taken care of	10,100
Total	150,000

WARNING.

WARNING.

PROVINCIAL BUDGET—1915.

"A."

Kilometers first-class road "105."

Income:	
Fiscal year 1915	₱155,000
Expenditures:	
Maintenance first-class road, 105 kilometers, at ₱500	₱52,500
Maintenance equipment	5,000
New construction	97,500
Total	155,000

"B."

Kilometers first-class road "101."

Income:	
Fiscal year 1915.....	P150,000
Expenditures:	
Maintenance first-class road: 86 kilometers, at P900; 15 kilometers, at P500....	84,000
Maintenance equipment	9,000
Replacing one steel bridge.....	15,000
New construction	46,100
Total	150,000

FISCAL YEAR—1916.

"A."

Kilometers first-class road 107.

Income	P157,000
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"B."

Kilometers first-class road 107.

Income	P152,000
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In the comparison indicated the province started in 1912 with 70 kilometers of first-class road. In 1914, under "A", the province was able to continue its progress and had in the past two years expended for maintenance P97,650, while under "B" this same province was forced to reconstruct its roads that had become impassable leaving it without funds for new construction—"B" having spent for maintenance in the previous two years but P60,600, or P37,050 less than the required expenditure under "A". However, this pennywise saving of P37,050 necessitated an expenditure of P150,000 on maintenance for the year 1914.

Under "A", in 1914, the province had 92 kilometers of first-class road and appropriated for maintenance P51,000. By reason of the increase in roads the revenues had increased by P10,000, leaving P99,000 for new construction. Under "B", in 1914, the province had 101 kilometers of first-class road and was forced to appropriate its entire revenues for reconstruction of the one time first-class roads. Under "A" the province was able to maintain its first-class roads in good condition with P51,000 while under "B" its entire revenue of P150,000 was required for maintenance.

In the case of "B", the roads had developed during the past six years a heavy traffic as a natural result of the improved highways. However, due to the subsequent deteriorated condition of these roads, the traffic decreased, affecting not only the provincial funds but also the private business of all users of such roads.

The tabulation also shows that the proper care of equipment is of the greatest importance, from a purely business point of view. Under "A", in 1912 and 1913, P10,000 was expended for the upkeep of equipment while under "B" during the same period but P4,000 was expended for the upkeep of equipment. In 1914, "A" had all equipment intact and "B" was forced to spend P12,000 to repair or replace the equipment that had deteriorated to such an extent that it was unfit for the work required in reconstructing first-class roads. And even in the following year, 1915, "B" had to make additional extensive repairs to the light equipment which had also been neglected.

In 1915, under "A", 105 kilometers of roads in first-class condition existed, leaving P97,500 for new construction while under "B", there were but 101 kilometers of first-class roads still needing heavy repairs, and but P46,100 remained available for new construction, or less than one-half as much as under "A".

To some the above outline will appear exaggerated, but this is by no means the case, as such conditions have actually developed in some of the provinces in the Philippine Islands, and in one case the effect, as shown in the tabulation under "B", was greater because of another factor; namely, the roads were not constructed under approved methods for first-class road work.

The maintenance of all macadamized roads whether of stone or gravel construction must be taken seriously. In all civilized countries continuous attention is given to the preservation of the old macadamized roads as well as all newly constructed ones. In

countries with a colder climate, where snow and frost play a part as destructors to macadamized roads, the questions arising for proper maintenance are different from those of tropical countries. Here, heavy cloudbursts and continuous rainfall on the one side and extreme heat and long droughts on the other, periodically act on the roads. Vegetation in the colder climates is not as luxuriant as in the Tropics; in the former, vegetation requires little attention, while in the Philippine Islands it requires special attention. And again, in each part of the Philippines the duration of the rainy and dry seasons vary; class or kind of traffic, and material used for construction differ on all roads, necessitating different measures and requiring more weight on certain features of the work in one province than is required in another. And, further, no two kilometers are alike in detail as concerns quality and condition of the metaling, the grades, and the drainage of the road the population living near the road and the traffic on the road, which requires that each kilometer be treated differently, laying more importance on the one or the other part of the work.

Let us assume a road is well constructed in every respect; then the maintenance work required consists in mending the smallest defects before same grow to be serious. Such small defects can only be seen and at once mended by one who is on the road continuously and is trained for this work, who notices the slightest change developing at any time. Realizing that economic maintenance work can only be accomplished by curing injuries to the road while they are still small, the *caminero maintenance system* has been adopted for the Philippine Islands. As the name indicates, in this system the *caminero* chiefly, if not entirely, is to act. The full value of this system is reached by developing the highest efficiency and effectiveness of the *caminero* or individual road laborer.

What is this *caminero* system, and how does this system develop the highest efficiency of individual road laborers, and why is this the most economic way of maintaining all macadamized roads?

Roads throughout the Philippine Islands are classified by the Bureau of Public Works into first, second, and third class. We are herein interested in the maintenance of first-class roads, which are those constructed of approved cross-section with a substantial foundation and a durable and continuous surfacing and legally designated as such. The maintenance of these roads is placed in charge of the district engineer by resolution of the provincial board. The district engineer is, therefore, responsible for the systematic organization necessary for the work required. One competent, reliable foreman is placed in charge of all maintenance work who is termed "*general road foreman*". The efficiency and effectiveness of the organization depends upon the quality and ability of the foreman. He must be a man thoroughly acquainted with all laws and regulations pertaining to the roads and thoroughfares in the Philippine Islands. He must be a man of executive ability, with personal influence over the people with whom he has to deal and whom he directs. He must have full knowledge of all methods and practical experience in road and concrete construction and maintenance of equipment and tools. The general foreman who has 70 kilometers, or more, of first-class road to care for should have a storehouse and an office in the most centrally located part of his system. In this storehouse should be assorted, and preserved with grease or paint, a sufficient supply of all road tools in order that he may be able to supply extra gangs with tools and replace worn-out tools in the hands of the *camineros* on the shortest notice. The following tools should be neatly assorted in each maintenance storehouse: Wheelbarrows, shovels, hoes, picks, rock hammers, axes, grass-hooks with whetstones, rakes, tamps, potato forks, drills, sledges, buckets, trowels, paint brushes, wrenches, cross-cut and rip saws, block and tackles, oil, grease, graphite paint, coal tar, and waste. In the storehouse should also be number plates for bridges and kilometer posts, warnings with road laws printed thereon for distribution along the road, and in the office the storekeeper should have a supply of time-books, *Caminero Manuals*, unit cost accounting Forms No. 59, memorandum receipt blanks, and a card system for accounting for all tools and equipment; sample of such card is as follows:

[Face.]

Rake (road, 14 teeth).

Quantity.	Unit.		Unit value.	Total value.
46	Pieces	Taken over July 1, 1911.	P1.45	P66.70
50	do	Taken over January 1, 1912.	1.50	75.00
20	do	Condemned January 30, 1912	1.45	29.00

[Back.]

Quantity.	Unit.		Unit value.	Total value.
10	Pieces	Maximo Cinco	P1.50	P15.00
16	do	Mariano Lagos	1.45	23.20
6	do	Jose Gonzales	1.45	7.25
10	do	Jose Gonzales	1.50	15.00
Etc.		Etc		

NOTE.—Difference must be in storehouse.

Serviceable tools should be kept separated from all worn-out tools that may be awaiting condemnation. No unserviceable tools should be left in the hands of the camineros but should be taken up by the foreman at once and replaced with serviceable tools.

When the foreman finds tools in an unserviceable condition in the hands of the camineros he will take them up and, if possible, repair them at once. A great deal of money can be saved and the services of tools retained for a longer period if they are repaired before becoming entirely worn-out.

The foreman, in his office, gathers Form No. 59 as accomplished by the capataces, corrects and forwards same about every ten days to the district engineer. This is then used as a basis for the monthly maintenance report on Form No. 67.

The *general road foreman* is furnished transportation, preferably a motor cycle, in order that he may be able to visit all parts of the roads with ease and without loss of time. He directs all work of the camineros, subject to the general supervision of the district engineer. The foreman cannot be on every piece of work continuously. At times he will be even entirely occupied with repairs to greater damages and, therefore, *capataces* are placed in charge of regular road sections, such sections may be from 8 to 14 kilometers long. Sections longer than this will ordinarily result in ineffective maintenance supervision. If the section is 10 kilometers or more in length, transportation is furnished the capataz, preferably a bicycle. In some provinces the capataces furnish their own transportation. The personal equation enters into consideration when adopting one or the other method. Generally better service may be obtained from capataces if the province provides a bicycle, which morally obliges the capataz to use same, he being also held responsible for the condition of the bicycle. The capataces should wear badges clearly exhibited at all times when on the road. The capataz mounted on a bicycle can get over each kilometer several times daily. In addition to the ordinary duties of a road capataz, he keeps the time of all camineros; sees that all road laws and municipal ordinances concerning the roads are complied with by the people and enforced by the municipal authorities. He files all legal complaints against violations before the proper court, with the consent of the general foreman. Capataces must be acquainted with all the details and peculiarities of their road sections and must know how to remedy all defects. He must create an *esprit de corps* amongst his camineros that will raise their interest and pride in their work. A good capataz will be able to keep a healthy competition between his camineros.

The *caminero* is identified by the condition of his section. These caminero sections are now one kilometer in length. After the greatest efficiency of the caminero system has been developed and the road has been brought to an approved first-class standard, it is anticipated that such sections may then be enlarged so that one caminero can care for 2 kilometers, which will depend, however, on the nature of the road and traffic and the work required to keep the road in perfect condition. The caminero must fully realize the meaning and value of the old saying, "A stitch in time saves nine,"

or translated into the road language, "A wheelbarrow in time saves a cubic meter of stone, half a day of one mule team, one hour of road-roller work, and one hour of the foreman's, capataz's and three laborers' time."

The Caminero's Manual goes into details of the work required of the caminero and gives an excellent study for him. In addition to this Manual, directions for detail work of a special nature, illustrated by sketches (blue printed) will help a great deal to make the caminero realize and understand the importance and nature of his work; explanations should be given in their dialect. As for example: See Plate I.

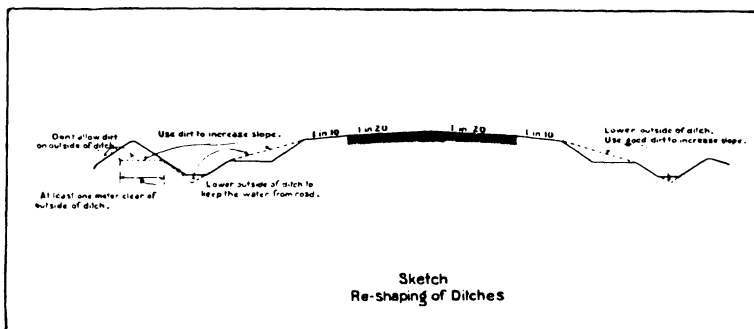


Plate No. 1.

The caminero should always live near his kilometer and, if possible, on his kilometer and he must consider his job as lifelong; that is, the caminero should take up his work like a trade at which he wants to perfect himself until he becomes an expert therein. He must be the best authority on the defects of his kilometer. Only with this spirit can the highest efficiency of the caminero be secured.

He must be educated to realize fully the most important factor of road construction and maintenance; that is, "drainage." Most of the engineers in these Islands will have observed that wherever roads have been built with insufficient engineering supervision ditches have been constructed that do not drain. It seems that some believe that ditches are some kind of a border for the road, at the same time having to collect the water and that is all. The ditches dug by untrained men are usually too narrow and too deep with, at times, perpendicular slopes, which is all wrong. Generally speaking, a ditch should be shallow and wide with easy slopes because it is much easier to get water out of a shallow ditch than out of a deep ditch. Wide ditches with easy slopes, as shown by Plate II, require least attention. Ditches serve to lead water away from the road and not to collect the water and hold it near the road.



Plate No. 2. A properly drained road, shoulders and slopes sodded with Bermuda grass, Province of Leyte.

The caminero must be trained to repair all defects to the metaling, such as breaking large stone as soon as they appear at the surface, patching soft places and ruts.

One thing must be realized by all, "that the road, like a house, should have a dry cellar, a firm foundation, and a tight roof." The caminero must keep the ditches and grade dry by keeping the ditches clean and the laterals open, by having the shoulders and berms sufficiently sloped and smooth, that the water may readily drain off, allowing on the shoulder slopes and ditches no larger vegetation than is allowed on a good lawn. The firmness of the foundation must have been considered during construction and the caminero will not be able to improve same, but when he patches a weak place he must keep this in mind, that he will not place loose stone over a faulty place, but will first pick up the poor material and then thoroughly tamp the base as well as the new cap. I have seen ruts that have been patched by placing new stone therein and then tamped lightly, expecting the traffic to do the rest, which is all wrong. Such practice results in water falling on the road, penetrating through the patches and then collecting on the surface over the old rut where it must remain until it gradually percolates through the metaling into the subgrade, thereby weakening the old cap still more. Such method of patching does more harm than if the rut had been left untouched. In patching a rut, pick the defective place down to the base course, repair any defects therein, tamp the repaired base, and then place the new cap on top and tamp same thoroughly, making it tight so the water will run off.

In order that the caminero may be able to do all the required maintenance work at the right time he must have the following tools: One wheelbarrow, one shovel, one hoe, one pick, one rock hammer, one grass hook, one rake, one broom, and one tamper, for all of which he is held responsible. He keeps these tools over night in his house but he must know that they are not turned over to him and his family for whatever use they can make of them but that they are solely for his road work and must be kept in excellent condition.

HINTS.

A few hints to engineers in charge of road maintenance work may be appropriate in this place.

Conditions for roads vary so greatly that the proper method for maintaining first-class roads must vary, but the realization of the importance thereof and a real interest in this work and a careful study of the conditions and possible methods will always produce results.

Concerning drainage.—Mr. Clifford Richardson, in a paper on drainage and foundations, published in the proceedings of the American Society of Civil Engineers for April, 1912 states:

"There is probably no highway engineer who does not recognize the importance of drainage but it is an astonishing fact that nevertheless very few roads are properly drained. This is generally neglected because a proper study has not been made of the character of the subsoil on which the road is built and perhaps more so because of the additional expense it involves. When some of our public officials state that a good broken stone highway of a modern type can be built for less than \$6,000.00 per mile the engineer hesitates to increase the cost to a point which will lay him open to the serious criticism of extravagance by introducing proper drainage."

A properly constructed subgrade providing sufficient drainage, is shown in the view appearing on the title-page.

Concerning sodding.—I would like to invite attention to the fact that in the tropical climate of the Philippine Islands vegetation is very luxuriant and therefore more harmful to our roads than is true in colder climates. Vegetation when allowed to grow at random will interfere with the drainage because the surface water cannot drain off. The cost of caring for same through continuous cutting and by digging out harmful vegetation is very considerable; in fact, I have found 75 per cent of a caminero's time is needed to keep the common vegetation down and only 25 per cent of his time therefore, is available for other important work. To eliminate this evil, and to secure more of the caminero's time for the important work in the ditches and on the metaling, Bermuda grass should be planted on the shoulders and slopes. This grass forms a thick carpet, preserves the grade in good shape and, not growing large, requires the least

attention. I have found that this grass does not need cutting oftener than every three months which means that we secure 75 per cent of the caminero's time for other work. Bermuda grass grows on any soil, even on disintegrated sand or gravel, and gives the road a neat appearance. Do not shirk when you find that it costs money to dig out the old vegetation and plant new Bermuda grass because you will save money in future years. In some cases I have planted Bermuda grass at a cost of less than ₱20 per kilometer and in other cases the cost was ₱100 per kilometer. This matter should be given special consideration before turning over a new road to the caminero forces. A newly constructed road section with Bermuda grass planted on shoulders and slopes is shown by Plate III.

Concerning depository material.—For patching the metaling, maintenance material is deposited in neat piles on each kilometer, places of deposit being especially provided. I have generally found that insufficient care is taken in securing good stone for these depositories. On water-bound macadam roads, where a hard and durable broken stone is used for maintenance, the material in the depositories should not exceed 4 centimeters in the greatest dimension. For gravel roads screened materials should be deposited, no particles of gravel exceeding 2.5 centimeters in diameter. Better results will obtain if the



Plate No. 3. Showing condition of a newly constructed road with shoulders and slopes sodded by construction forces preparatory to establishment of caminero maintenance, Province of Pangasinan.

gravel runs from this size to the size of a pea so proportioned as to have the least amount of voids. For coral and limestone roads the maintenance material as deposited may exceed in a measure the maximum dimension of 4 centimeters. In order to do effective work with the caminero force it is essential that the best available material be secured for these depositories. If the caminero is made to break his own stone for the patching he will fall behind in his work and numerous defects will have to remain unattended to; experience has proven to me that the camineros will kill more time in breaking stone than on any other work. The expression fits here, "It is ideal for soldiering."

An approved type of depository is found in Plate IV.

Concerning uniforms for camineros.—Experience in these Islands has proven to private employers, as well as to the Government agents, that the individual native laborer retained for a long period in the service will take more pride in his work, do better work, and is more faithful than the day laborer who works only long enough to secure sufficient funds to be able to find employment elsewhere. There are natives who love their work and take pride therein.

How can you secure them?

By picking your men for this work and impressing on them the importance of their work, adding distinction to their personalities,



Plate No. 4. Approved type of sod-depositories, properly located and filled, Province of Ilocos Sur.

and showing appreciation of their good efforts. Distinguish him from the ordinary laborer and create an *esprit de corps* and a strong competition in your organization, something on the order of the good spirit promoted in a strong military organization, believing in discipline. A uniform dress for all camineros in the province will help much to bring about this result. Red is supposed to be a cool color, blue or black being considered hot, and for this reason red clothes, somewhat uniform in cut after the custom in each particular province, is very recommendable.

There is another advantage in having camineros in such uniforms—it will appeal more to the practical man who has to inspect the road. The camineros are not the only laborers busying themselves on or near the road or passing over the road; it is often hard to find the caminero, especially when you have no time to spare to make inquiries. The caminero in a red uniform is not as apt to lay down and idle or go to his near-by house, or into a tienda if dressed in red. His excuse, that the inspector had passed him but probably did not see him will be more improbable than if he wore ordinary clothes and could run the risk of being passed unobserved when doing wrong. (See Plate V.)



Plate No. 5. A caminero in uniform with service stripes—complete set of working tools indicated—Province of Leyte.



Plate No. 6. A road constructed contrary to approved methods and requiring reconstruction.

Concerning the limit of caminero work.—Camineros can only attend to repairs of small defects and when the defects get beyond his limit—that is, a one man's job—he must be given extra laborers to heal such defects as quickly as possible, in order to avoid his being held on one job leaving the smaller defects unattended to. A practical foreman will be able to judge when a caminero should be furnished with helpers. In provinces where a good spirit and a strong competition is in existence between the camineros, the camineros often have members of their families help them in attending to their work, which should be encouraged. It must be realized by all concerned that only by means of this caminero maintenance organization can we get the maximum use out of the second course or the metaling cap. Whenever the second course or the cap is worn out by the traffic, which will become evident when a great amount of the base course material appears on the surface, the road must be resurfaced because the metaling material has reached its limit. How frequent roads have to be resurfaced will depend on the quality of the material used for the cap and the amount and class of traffic. It is believed that with the average road material found in the Philippine Islands, well-maintained roads will not need resurfacing or a new second course more than once in every five years.

One view of a road neglected, and one of a newly resurfaced section is shown by Plates VI and VII.

Concerning binder.—To secure a tight cap or a water-bound surface a certain amount of binder and filler of voids is required, varying in quantity and quality with each surfacing material used. Broken



Plate No. 7. A road reconstructed under approved methods, Province of La Union.

coral and limestone will require very little or no binder; hard, igneous stone and gravel require more binder.

Binder serves to fill the voids and cement the metaling. Limestone or clay and sand mixed are the most ideal materials. Clean sand while filling the voids will not cement the stone. Where sand is the only available material as little as possible should be used and then only when mixed with some clay; because sand in excess of the actual necessary will serve as separator rather than as binder. Sand does not shed water, but allows the water to percolate readily, which will effect raveling of the surface and softening of the subgrade. In all cases the second course should be rolled to completion, leaving the minimum possible voids and then the binder should be added.

When camineros patch a defective place, they prefer to place the new material mixed with an excess of binder, because this saves a great deal of tamping; or they place the new material in the depression and after little or no tamping will cover the patch with binder (sand for instance). This kind of patching does more harm than none at all, as the water will not run off but will be held by this binder and then percolate through the poorly patched surface, softening the cap and subgrade, the defect thereby growing. I have even seen sand placed on the finished road, probably in lieu of patching or resurfacing, which gave the road for the time being, while dry, a smooth appearance. The effect of this procedure is, that during a rain the water is retained on the surface softening same until the water percolates through the cap. If the original cap is sufficiently hard and the crown of the metaling well defined, the first rain will wash off this sand leaving same deposited on the edge of the surfacing, where it is held by the grass on the shoulders. This will offer sufficient obstruction for the water of following rains for holding same on the surfacing or create mud at the edge of the surfacing. Another point has to be remembered, that sand or other loose binder, thus spread over the surface, will cover the defects, leaving same unrepaired and growing under this cover; in other words you deceive yourself.

Concerning animals running at large.—Act 82 (Municipal Code), section 39 (aa) as amended by Act 1791, section 2, reads as follows:

"No. 1791.—An Act to amend in certain respects Act Numbered Eighty-two, known as the Municipal Code.

"SEC. 39 (aa). Establish and maintain municipal pounds and fix the fees for poundage; regulate, restrict, or prohibit the running at large of domestic animals and dogs unlicensed, and provide for the distraining, impounding, and sale of the same for the penalty incurred and the cost of the proceedings, also impose penalties upon the owners of said animals for the violation of any ordinance in relation thereto: *Provided*, That 'large cattle' within the meaning of Act Numbered Eleven hundred and forty-seven shall be disposed of in accordance with that Act."

The annoyance to drivers and owners of motor and faster vehicles on account of animals running at large on the highways and streets is well recognized and everyone will know of some more or less serious accidents chargeable to this cause. A matter concerning us now especially is the damage done to the road by such animals. Carabaos and hogs are the most serious offenders and destructors of our good roads. Carabaos step down shoulders and slopes and work up mud-holes in the ditches, obstructing the free drainage of the water, which is more noticeable in ditches with a light grade. Hogs have no regard for the appearance of a road or the proper drainage of surface water. Nature endowed this omnivorous mammal with a long mobile snout, which it uses with special delight in rooting up the grass on slopes and shoulders, making it impossible to maintain the roads in good condition with our regular caminero force. Economy in effective maintenance demands relief against these abuses. The cost to repair the damage done to the road by hogs is considerable.

Since all municipal councils shall take action in the matter of domestic animals running at large, these abuses can be eliminated through proper ordinances and the strict enforcement of same. It is very regrettable that there is so little attention paid to this matter by the municipal authorities, showing a lack of coöperation with the efforts of the provincial and Insular governments.

I have found that the district engineer can do much to improve this condition, by taking this matter up with the municipalities in the following way: Write a circular letter to all municipal secretaries inviting attention to the above-quoted Act and request them to furnish

the district engineer with a copy of all municipal ordinances passed in compliance with this Act. Study these ordinances carefully and if you find them inadequate, direct a letter to the respective municipal councils, explaining therein the importance of the proper regulation of this matter and that it is absolutely essential that animals such as carabaos and hogs should be restrained from running at large, and suggest the most effective ordinances for enforcement. If in any municipality adequate ordinances are not enforced, write to the municipal president and request enforcement thereof as a part of his duties. If this proves of no avail present a complaint to the provincial board against such official. A great deal more can be expected from the municipal presidents, if they understand the importance of the enforcement of these ordinances and if the disgraceful and careless conditions existing are properly pointed out to them.

AN EXPERIMENT IN MACADAM ASPHALT CONSTRUCTION.

By C. E. GORDON, Division Engineer.

This experiment was applied in the reconstruction of a section of the Manila-South Road within the municipal jurisdiction of Pasay.

The length and width of road covered was 1,678 meters and 5 meters, respectively. The shoulder width was one meter. In accordance with the second recommendation of the "special committee on bituminous materials for road construction," of the American Society of Civil Engineers, made in February, 1912, a crown of one-third inch to the foot was used. The reason given by the committee aforementioned is as follows:

"The investigations and observations of the committee to date have convinced it that the crown generally used in the construction of macadam roads is excessive when bituminous materials are used, and that a crown of one-half inch to the foot should be avoided when a lesser crown can be secured without detriment to the surface drainage."

A 24-hour census was taken for a period of eight and one-half days, from May 11 to May 18, 1912. The census given is as follows:

Manila-South Road traffic census.

Date, 1912.	Time.	Single rigs.	Double rigs.	Carabaos carts.	Auto-mobiles.	Total day.	Total night.	Direction.
May 10.	{ 6 p. m. to 7 a. m.	140	4	0	32		176	From Manila.
		126	4	1	32		163	To Manila.
		300	4	6	30	340		From Manila.
May 11.	{ 7 a. m. to 6 p. m.	292	4	1	13	310		To Manila.
		480	12	42	37		571	From Manila.
		312	17	36	19		384	To Manila.
May 12.	{ 6 p. m. to 7 a. m.	312	16	0	50	378		From Manila.
		280	14	1	38	333		To Manila.
		316	17	0	92		425	From Manila.
May 13.	{ 7 a. m. to 6 p. m.	296	15	0	86		397	To Manila.
		293	15	2	12	322		From Manila.
		280	14	2	15	311		To Manila.
May 14.	{ 6 p. m. to 7 a. m.	227	13	2	56		298	From Manila.
		267	15	2	50		334	To Manila.
		296	17	5	19	337		From Manila.
May 15.	{ 7 a. m. to 6 p. m.	355	25	3	20	403		To Manila.
		248	8	1	44		301	From Manila.
		231	6	0	39		276	To Manila.
May 16.	{ 6 p. m. to 7 a. m.	286	23	0	25	334		From Manila.
		275	21	0	19	315		To Manila.
		213	8	0	60		281	From Manila.
May 17.	{ 7 a. m. to 6 p. m.	234	7	0	53		294	To Manila.
		232	16	10	12	270		From Manila.
		243	16	6	15	280		To Manila.
May 18.	{ 6 p. m. to 7 a. m.	217	8	0	39		264	From Manila.
		199	11	0	36		246	To Manila.
		244	14	2	11	271		From Manila.
May 19.	{ 7 a. m. to 6 p. m.	255	13	1	6	275		To Manila.
		240	6	0	51		297	From Manila.
		282	7	0	46		335	To Manila.
May 20.	{ 6 p. m. to 7 a. m.	373	22	2	21	418		From Manila.
		306	20	1	18	345		To Manila.
		330	20	7	93		450	From Manila.
Totals for 204 hours.		360	19	6	86		471	To Manila.
		9,340	451	139	1,275	5,242	5,963	
		Grand total	11,205					

Average per hour, 55 (approximately).

It will be noted that the traffic amounted to 9,930 animal-drawn vehicles and 1,275 automobiles for the period of observation. The average traffic per day was 1,318 vehicles. Because of the worn and otherwise unknown condition of the surfacing found upon the road, the writer directed that it be perfectly scarified by the rollers,



Macadam asphalt section of the Manila-South Road.

picked-up with picks, and screened. The surfacing found was then redeposited upon the road and sufficient new stone added. In this way a definite known thickness of foundation was obtained. In some places the first surfacing was completely worn away.

The first course, or foundation course, of the new work was placed about 5 inches, thick, loose, upon the former subgrade, rolled, filled, and watered thoroughly. As a filler, various materials were used—the fine sand that had been screened out of the gravel, and the road detritus found upon the road. Also the larger gravel was removed from the gravel screens and used in the foundation. In this way no waste of materials occurred. This foundation was thoroughly rolled and presented the appearance of an ordinary macadam road surface when finished except that it was a little rough in order to bond better with the bituminous course that was to be placed on top.

This foundation course was constructed with a crown parallel to the crown of the finished asphalt surfacing, thus obtaining a uniform thickness to the bituminous course.

For the bituminous course, clean, dry, broken stone was spread evenly on the foundation course to a depth of about 3 inches, loose. This course was thoroughly rolled. After the rolling was completed a very light spread of gravel was made on the rolled stone. The gravel spread was of such a size as to have passed through a screen of 1 inch mesh and to have been rejected on a screen of ½-inch mesh. The amount spread was approximately 0.372 cubic meter per 18 linear meters. The purpose of spreading this gravel was to better fill the voids of the broken stone.

After the above-mentioned gravel had been spread, the first application of asphalt cement was made.

A Standard Oil product was used, known as macadam asphalt cement prepared especially for the tropics, and analyzing as follows:

Specific gravity.....	1.00
Melting point..... C.....	103
Penetration at 25° C. for 5 seconds using Vicat needle..... millimeters.....	4.0
Free carbon..... per cent.....	0.37
Solubility in 88° B. petroleum ether..... do.....	73.6
Residue on Petri glass.....	sticky
Water soluble materials (organic matter)..... per cent.....	0.14
Fixed carbon..... do.....	17.3
Paraffin..... do.....	0.27

At first, the quantity applied amounted to 2.4 gallons per square meter. This amount decreased until, at the completion of the work, the amount applied approximated 1.6 gallons per square meter. In pouring the hot asphalt it was found necessary to pour in two directions; that is, to pass from left to right and then back over the same ground, or from right to left. In this way both sides of the broken stone were properly coated. It was particularly necessary to pour from two directions during windy weather.

Immediately after the asphalt was applied a coat of clean gravel was spread thereon. The gravel was of the same size as described above and as spread upon the broken stone. The amount applied averaged 1.05 cubic meters for every 18 linear meters of road. This course was then rolled until the surface presented a smooth appearance. Additional gravel, in small amounts, was applied where necessary during the rolling. The surface was then thoroughly swept so as to remove all loose gravel and dust. Upon this surface was spread the second coat of asphalt cement. The amount applied averaged 0.6 gallon per square meter. Immediately after the application of the

second coat, fine gravel was spread thereon. The amount of gravel spread averaged 0.61 cubic meter for every 18 linear meter of road.

Three different kinds of material were used in different parts of the work. At first a coarse sand was spread upon the second coat. As a result considerable of the larger particles of gravel was taken up by the asphalt but the fine material was ground up by traffic and was finally removed from the road. This left a rough surface, which roughness was partly removed by the roller and partly removed by the traffic.

Another method was to use a fine gravel that had passed a $\frac{1}{2}$ -inch mesh screen and had been retained upon a $\frac{3}{4}$ -inch mesh screen. This gravel did not produce as smooth a surface as the following method, but as the coarseness of the gravel produced a coating over the broken stone, it will doubtless be the most durable of any of the methods tried. Another method tried was to use a fine pea-sized gravel which had passed a $\frac{1}{4}$ -inch mesh screen and had been retained upon an $\frac{1}{2}$ -inch mesh screen. This gravel produced a very smooth surface, apparently perfectly homogeneous and very closely resembling a sheet-asphalt pavement. Notwithstanding the smooth, fine finish, the use of gravel of this size is not recommended for the following reasons: (1) The gravel is not of a sufficient size to prevent wave-formation; (2) it fails to provide a sufficient body to form a coat similar to that formed by the larger gravel and, therefore, its use fails to permit durability to the same extent as the larger gravel.

To obtain rapid construction, heaters having a capacity of 800 gallons should be had; that is, four heaters, each heater of the capacity of one of the heaters used upon this work. It is very difficult to obtain more than two tanks from any heater per day and to get two tanks a fire had to be started at about 2 a. m. Also as the service upon the heaters is particularly severe they are liable to get out of order as one did upon this work. If four heaters are in commission, the placing of one out of commission would not affect the progress of the work very seriously.

It is absolutely out of the question to attempt to construct asphalt macadam roads during wet weather, or when the stone is even damp. The temperature of the asphalt being about 380° F. causes all moisture to form and pass off in steam as soon as it comes in contact with the hot asphalt, thus destroying in part the perfect adhesion that should be had for a successful job.

The estimated cost of this work was ₱22,360.32. The actual cost was ₱25,949.52 as itemized under:

	Kilometer 1.	Kilometer 2.	Total.	Average per square meter.	Average per square yard.
Resurfacing 2 kilometers (10,000 square meters):					
Scarifying	₱625.56	₱604.56	₱1,230.12	₱0.123	₱0.103
Spreading stone	365.70	374.63	740.33	.074	.062
Cost of stone	3,483.00	2,625.00	6,108.00	.611	.510
Spreading sand	40.00	none	40.00	.004	.003
Cost of sand	350.00	350.00	700.00	.07	.06
Rolling	469.39	229.18	698.57	.070	.058
Sprinkling	70.06	206.95	277.01	.028	.023
Total resurfacing	5,403.71	4,390.32	9,794.03	.980	.819
Asphalting 1,678 lineal meters (8,390 square meters):					
Spreading stone, second course	331.25	631.58	962.83	.115	.096
Cost of stone	1,767.00	2,625.00	4,392.00	.525	.440
Rolling stone, second course	329.17	413.99	743.16	.089	.074
Spreading asphalt, first course	188.15	418.46	606.61	.073	.061
Spreading gravel	44.13	85.99	130.12	.016	.013
Rolling asphalt, first course	126.08	188.83	314.91	.039	.032
Spreading asphalt, second course	157.66	355.22	512.88	.061	.051
Spreading gravel	39.70	80.45	120.15	.014	.011
Rolling asphalt, second course	87.49	349.92	437.41	.052	.043
Cost of gravel	162.00	240.00	402.00	.048	.040
Cost of asphalt	1,656.00	2,460.00	4,116.00	.492	.411
Brooming	90.05	none	90.05	.011	.009
Miscellaneous, rents, etc	1,200.00	2,117.37	3,317.37	.396	.331
Total asphalting	6,178.68	9,966.81	16,145.49	1.931	1.612
Grand total (complete cost including all engineering expenses and rental of equipment)	11,592.39	14,357.13	25,949.52	2.911	2.052

It may be of interest to compare these costs with those of the city of Manila in the construction of the pavement upon the Bagumbayan:

	Stone per cubic meter.	Finished road per square meter.	Amount bitumi- nous material per square meter.
Bagumbayan	₱3.67	₱2.10	Gallons, 2.75
Manila-South Road	7.63	2.91	2.40

The stone used upon this work was obtained at Los Baños. The cost on the cars at Los Baños was ₱4.19, or ₱0.52 greater than the cost of stone in place per cubic meter in the Bagumbayan work. To this should be added the transportation from Los Baños to Pasay, the unloading costs and the transportation and placing in the road. This is very largely the cause of the higher costs. This stone is not as hard as the writer would desire to have it.

Before beginning the construction of this work the writer had the delivery of stone advertised in the Manila papers and did not receive bids which could receive favorable attention. One bid only was received from a local contractor. Having had considerable trouble with this contractor in obtaining sufficient deliveries on former occasions I took the trouble, on the 17th of March, to make a personal investigation of his quarry. This investigation convinced the writer that this contractor would not only be unable to deliver material in sufficient quantities but that he would be absolutely unable to deliver broken stone of the proper size. Consequently in order to construct the road the writer was obliged to order the Los Baños stone to be used.

It has developed in the United States that hardness in the stone is not essential to superiority in the construction of bituminous pavements. It seems to be very well established that the hard trap rocks obtained in the neighborhood of New York City are far inferior to the comparatively soft rocks, as limestone, when used on this class of pavement. Several authorities, notably Mr. Clifford Richardson, take the position that the very best material in the construction of this class of pavement is the limestone. Consequently, it may be possible that the Los Baños stone will prove, under the heavy traffic conditions obtaining at Pasay, to be highly satisfactory.

A traffic census is to be taken for a period of one week from time to time so that it may be known what traffic the pavement is sustaining. A definite knowledge of the amount of traffic passing over a pavement is absolutely essential when making comparisons as to efficiency of the pavement. Also special maintenance apparatus should be obtained. A small heater of 40 gallons capacity and heating tools to be used in finishing off the joints between the old and new work should be obtained.

CONCRETE HIGHWAYS.

By H. V. MILES, C. E., District Engineer of Tayabas.

The people of the Islands are dependent upon roads and trails as a means of communication. The development of the railroad has been practically contemporaneous with that of the roads, and now comes the individual mechanical means of transportation—system tractors, gasoline and electric tractors and trucks, and a vast similar array of passenger vehicles. Regular freight lines of motor trucks have sprung into existence between towns, whose limit of load is simply the inability of the men in charge to pile on any more.

The springing into existence of this class of traffic has made maintenance a very vital question, not only in the Islands but every-

where else as witness the last Report of the New York State Highway Commission in which it is proposed to regulate the weight of the load as related to the width of tire so that the roads will not be destroyed. This is not the solution. Roads here are not built for pleasure vehicles and picnic parties, the main consideration is that the roads must be made to serve.

To the writer the solution is the concrete highway and while in the States lately, he studied the question whenever the opportunity presented itself.

New York State at present writing has 2,940 miles of highway with 710 miles under contract. Practically all of those 3,000-odd miles are bituminous macadam construction. Maintenance is costing \$2,000 per year per mile and still the roads are being destroyed. This report has the following to say: The former commission adopted a form of construction known as "bituminous macadam." It has been fully demonstrated that this class of construction has not given results, such as would justify the cost. This commission believes that it is impossible to obtain satisfactory results in highway construction until more attention is given to subsoil drainage, properly designed and constructed foundation, and a wearing course in which there is a more complete physical and chemical union of the units composing it; one which acts as wearing course only and not constructed so that its main function is to assist an improperly drained and poorly designed foundation.

Having these factors in view it seems wise, whenever possible, to construct a foundation of concrete and to cover this with a thin wearing course composed of bituminous macadam and screenings or sand which is economical in first cost and easily and cheaply renewed. The foundation of a road, so constructed, is good for all time and the wearing course serves the purpose of carrying all classes of traffic without rubbing, raveling, or raising a dust. To the writer this applies very aptly to the road system in the Islands, especially as the subgrade here is subjected to a severe amount of disintegration during the rainy season.

The best sample of this type of construction is job No. 991, New York State roads commission. This represents 4.67 miles of highway on Grand Island near Buffalo, N. Y.

Grand Island lies in the Niagara River between Lake Erie and Niagara Falls. It is subjected to all extremes of climate being ice bound from January to May, when the ice breaks and we have the famous flocs of ice over Niagara Falls, 18 miles distant downstream. It is very warm in summer, so if the concrete will withstand successfully the ravages of the climatic changes it will be adaptable to any other climate. Homes are being rapidly built upon the island and all supplies come to the wharf there from Buffalo and are distributed by motor trucks to the various consignees. Thus we have heavy traffic—bituminous macadam not adaptable, result despite climate, concrete highway.

This job involves the placing of 44,000 square yards of concrete for a roadway 16 feet wide. Gravel shoulders will increase the driving width by 3 feet on each side. The road is being put down on a red clay subgrade and the work is being crowned, both subgrade and finished surface, one-fourth inch to 10 inches. *There are no expansion joints whatever.* The concrete is laid 6 inches thick in one course and is being made of a 1:6 mixture of Universal cement and Niagara River gravel, which is clean and of good quality, and up to 2 inches in size. About 45 per cent of the aggregate is sand. It is pumped from the river by sand suckers. Longest haul, 2 miles. The cement cost \$1.30 per barrel on the job. The surface of the road is to be covered with tar and screenings. With these conditions and these prices the road is to cost 90 cents per square yard exclusive of subgrade preparation. The total cost of the work will be \$1.36 per square yard. High! Well the first cost, yes; but no more figuring on a construction proposition every five years nor a \$1,000 per year per mile for maintenance. Final cost—economical.

The concrete is being used very wet, so wet that it just stands up enough to permit of making the crown $\frac{1}{4}$ inch to 1 foot and with no stiffness to spare.

The following excerpts from the specifications are interesting.

Bottom course.—The bottom course of the road shall be as shown on the plans when rolled in place and shall be formed of concrete gravel 6 inches thick.

Top course.—The top course of this road shall be approximately $\frac{1}{4}$ inch in thickness when rolled into place and shall be formed of bituminous material T (tar) and H. O. (heavy asphaltic oil) and sand or screenings.

Concrete bituminous top course.—After the subgrade has been thoroughly rolled so that the surface conforms to a line parallel with and at the proper depth below the grade lines shown on the plans, gravel concrete shall be spread to a depth and cross-section shown on the plans. The concrete shall be mixed with only a sufficient amount of water so that when the mass is rolled with a 10-ton roller the mortar will not be forced through the stone to the surface but enough so there will be a slight appearance of moisture on it. The rolling shall continue until the aggregate is thoroughly compacted, care being taken to remove the roller before the concrete begins to take its initial set. At the end of each day's work the roller must be taken off the concrete. After removal of the roller the concrete shall not be disturbed for a period of 12 days, except that after it has taken its initial set it shall be kept sprinkled for forty-eight hours and as often thereafter as may be ordered by the division engineer.

In order to obtain a uniform surface timbers shall be placed at such an elevation that when the surface is struck with template it will give the proper crown and will be true and even with no depression or irregularity. After the surface of the concrete has become thoroughly dried, all dust if any, shall be swept off and one-fourth gallon per square yard of bituminous material T (tar) heated to a temperature of approximately 250° F. shall be sprayed on the concrete and immediately covered with a layer of screening one-fourth inch in thickness, which shall be spread uniformly over the surface before the bituminous material has become cool. It shall be rolled with a self-propelled road roller weighing not less than 5 tons. As soon thereafter as possible one-fourth gallon per square yard of bituminous material H.O. (heavy asphaltic oil), heated to temperature of 350° F. shall be spread on the rolled surface immediately covered with a layer of screenings one-fourth inch in depth and rolled to the satisfaction of the engineer.

When screenings are not available, clean sharp sand may be substituted with the permission of the division engineer.

The machine used for spraying these bituminous materials shall be of such construction that the amount to be applied can be regulated and spread on the road in a thin uniform sheet.

Force and equipment.—Mixer gang of 20 to 21 men, puts down more than 500 lineal feet for each full day—practically a kilometer in 9 days. A Koehring mixer capable of moving under its own power is used with boom and dump bottom bucket. In this gang are 1 foreman, 1 engineer, 1 fireman, 9 wheelers, 2 men handling cement, 1 at bucket-end of boom, and 4 follow-up men. These follow-up men have an easy job. As already stated the concrete is used very wet; it is dumped from the bucket and shoveling reduced to a minimum.

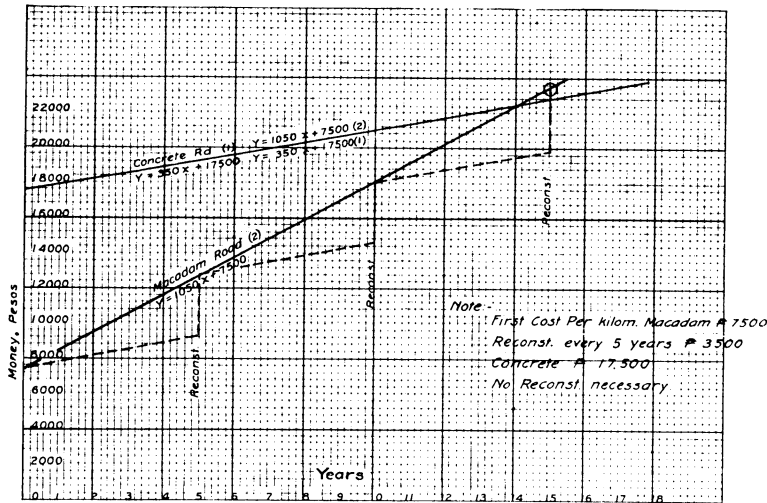
Two of the follow-up men handle the template, the scraping part of which is sheet steel, cut to the crown of the road and adjustable on its wooden frame so that it may be raised or lowered depending upon the depth of concrete and upon the height of the side rails. These rails are 4-inch timber, firm and solid in their position, and form an excellent track on which the wheels of the template move. The other two follow-up men help either directly behind the mixer in placing the concrete, or, working with long-handled shovels, follow behind the template, patting the concrete to an even surface. This is the only surface finish the concrete gets, no troweling or floating being done.

Men working on the subgrade keep considerably ahead of the mixer gang. In some places heavy cuts and fills have been required.

New York State despite its trap and basaltic rock, the best in the world for macadam roads, figures on 200 miles of concrete highway during the next year. A curve is worked up showing the comparison between a macadam road and a concrete road in the Islands. Assume first cost of concrete road at \$17,500 per kilometer with maintenance at \$350 per year. This maintenance cost seems reasonable as it is based on sand being used instead of screenings.

The first cost of the macadam road is assumed at ₱7,500 per kilometer and maintenance of ₱350 which is very conservative. Also assume every five years a reconstruction job amounting to ₱3,500.

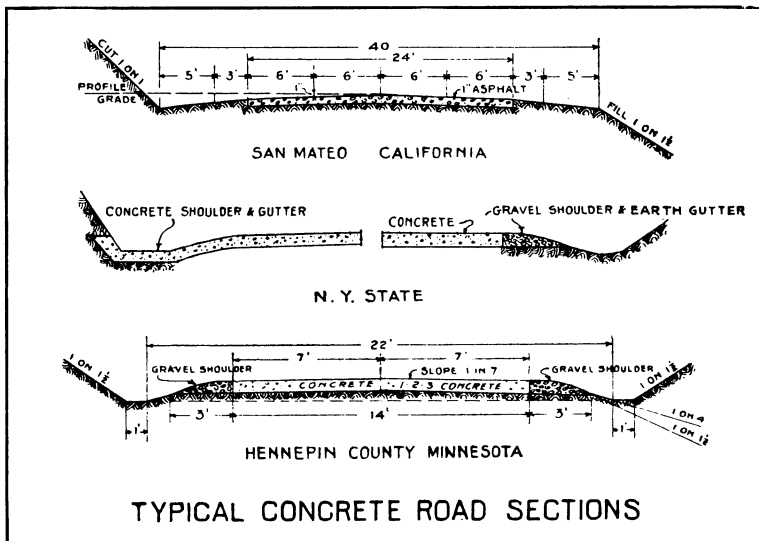
Using the years as abscissas and the money cost as ordinates and then plotting the resulting curves we find that the macadam road crosses the concrete road at the end of fourteen and one-half years, and from then on is much more expensive than the concrete highway.



Both of these curves are straight lines whose equations, developed from the slope and y intercept become $y = 1,050x + 7,500$ for macadam, $y = 350x + 17,500$ for concrete; substituting for x any number of years developed, shows the relative cost (y) of each type of construction.

Mr. Walter L. Page, of the Bureau of Good Roads, Department of Agriculture, Washington, D. C., has issued specifications for concrete highways and will shortly commence the construction of the same.

The State of California is building several sections of this type of construction. Several typical cross-sections are herewith submitted, showing a general idea of the method in vogue.



A COLLAPSIBLE BRIDGE AT MANGALDAN, PANGASINAN.

W. C. WEST, District Engineer.

The stream crossing at Mangaldan is one of the most important links in the chain of communication between the great rice fields around Binalonan, Asingan, and Tayug and the railroad at Mangaldan. It has long been a source of much vexation and consider-

able expense, both to the Government in providing a tolerable ferry for the Benguet automobile line's machines running between Dagupan and Baguio, and to private carriers in the way of ferry tolls for a service usually inadequate. However, since the river had the habit of subsiding during the dry season to a point where it was easily fordable, even for automobiles, and since bridge funds in Pangasinan Province have never been able to come within hailing distance of the demand for bridges, this project has always been passed over in favor of some more insistent problem.

This condition existed to June, 1911, when plans were prepared for a wooden pile trestle bridge having two 150-foot Howe trusses for a channel section. Eighteen thousand pesos was appropriated, but before construction could begin, the excessive floods of July, 1911, showed that this type of bridge would not be suitable for the Mangaldan River crossing. The clearance line of the bridge would have required an elevation of nearly 7 meters above the river bed in order to get it above extreme high water, and the drift which that height of trestle would stop would be such as to render the stability of a wooden pier problematical, to say the least.

After the last flood in October, 1911, had subsided it was found that the river bed had so scoured out that fording during the dry

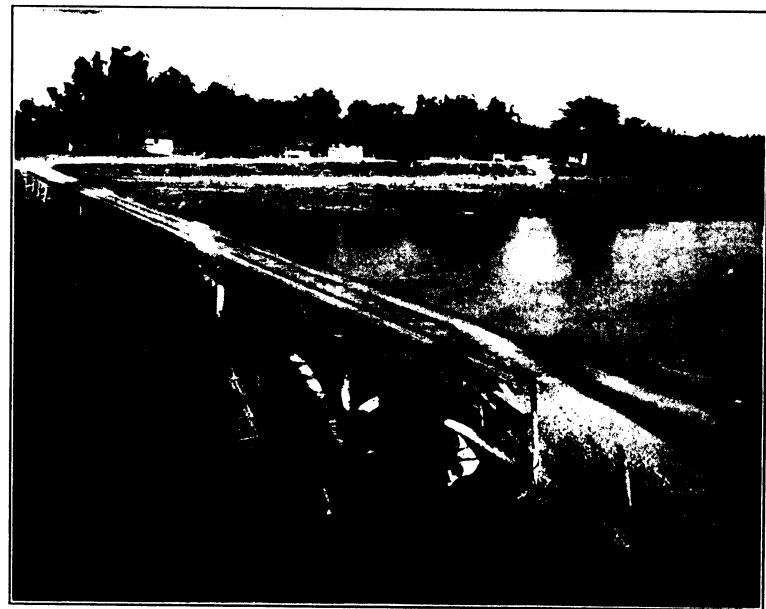


Plate No. 1. A collapsible deck bridge as constructed over the Mangaldan River, Province of Pangasinan.

season would no longer remain possible. The possibility of meeting the new conditions through the design of a low collapsible-deck structure occurred to the writer and was suggested to the central office. The present Mangaldan collapsible bridge was accordingly designed to compare favorably with a permanent ferry as to cheapness and to insure stability as to the drift problem. As shown under Plate I, the piles were cut off about 1.5 meters above low water, and are thus only approximated 4 meters out of the ground. It was expected that the water would rise sufficiently to take the runways off before very much drift began to run. After the pile-caps were submerged of course but little drift could lodge.

The piles, of third and fourth group native timber, were driven to incipient shattering by an 1,800-pound hammer, worked by hand. The river bed is a fairly hard-packed sand, but scours easily, hence every effort was made to secure as much penetration as possible, the average being about 4.5 meters. The piles were cut off and capped as fast as driven, and the driver was moved forward over the caps. The cut-off elevation was determined for each pile by using the water itself as a level. A gang of carpenters framed and placed the runways immediately behind the driver, so that the bridge was opened for traffic within a short time after the last pile was in

place. There are no abutments, a course of lagging being placed against the piles of the end bents, and the outer ends of the end runways hold back the fill and surfacing.

The length of the bridge was determined by observing the current when the water was about the height of the pile caps. It was noted that from a point 340 feet from the west bank to the east bank proper there was practically no current, hence a fill with rather flat slopes was constructed to take care of this portion, and was surfaced with gravel the same as a first-class road. During the last rainy season the bridge went out twice under floods, but this fill remained undisturbed, not even the gravel being washed off.

As originally designed, the runways were to be made up of two eight-by-tens separated by a two-by-four set flush with their tops and by 2-inch blocks under the lower line of bolts. This made the clear width of each runway 18 inches. No center flooring was contemplated, each runway being supplied with two fenders similar to the outer fenders shown on the plans. However, between the inner clearance of ordinary touring cars and the outer clearance of the big de Dions of the Benguet lines there is a considerable difference, and the simple experiment of laying down four lines of scantlings on a hard road, properly spaced, showed conclusively that the chauffeurs would need to have had some tight-rope experience in order to insure their being able to negotiate the runways safely, so the design was changed to the one shown in the cuts. The two-by-twelve hardwood planks were put in after the bridge was completed and the heavy cart traffic had worn the inner eighty-by-tens down nearly 2 inches.

Each runway is fastened to its neighbor by half-inch wire rope ties rove through 1-inch holes bored horizontally through the runways about a foot from each end, and the end runways on each side of the river are moored to the bank by means of 1-inch wire cables. The half-inch ropes are left loose enough to permit any runway to swing to a position at right angles to its neighbor without cramping the fastening. The center flooring is built in 10-foot sections, each of which is wired loosely to its runway. All timber is Oregon pine except the two-by-twelve wearing shoes and the two-by-four battens for the center flooring. Oregon pine was tried for these latter, at first, but would not hold the nails properly.

In operation the runways, carrying the center flooring, simply leave the pile caps as the water rises, and as they clear the six-by-eight dowel blocks they part in the middle of the river and float around. The moorings easily hold the bridge, and as the water falls men are stationed on the banks to keep the bridge afloat. As soon as the water gets below the pile caps the wire rope ties are disconnected, the four pieces of each span are floated to place and then lifted into position by means of a derrick wagon. This latter is merely a rather heavily braced framework mounted on four wheels, carrying a winch from which a half-inch wire rope puns over a rigid boom at one end of the framework. The axles are about 20 feet apart and the boom has an overhang of 12 feet. (See Plate II.)



Plate No. 2. Replacing collapsible deck after a flood period, Mangaldan River, Pangasinan Province.

The cost of the bridge was as follows:

54 timber piles	₱247.00
22,001 feet B. M. Oregon pine	1,318.71
Ironwork and wire rope, etc	430.60
Transportation	193.85
Labor	597.38
Supervision	679.59
Surcharges	700.04
Original cost of bridge complete	4,166.17
Cost of placing hardwood shoes and battens	420.46
Total cost, seventeen 20-foot spans	4,586.63
Average per span	269.80

The bridge went out first on July 31, 1912. Mangaldan River is not a swift stream at this point, so the bridge did not break up. The superstructure suffered no damage at all, but one pile bent was inclined downstream about 2 inches by the pressure of drift that lodged against it. It was then seen that this small drift, consisting of rice straw, cogon grass, and the debris from bamboo fish traps, as shown under Plate II, starts to run almost as soon as the water begins to rise; and that wooden piles, to insure safety for bridges of this type, should be cut off at a point not much more than 4 meters above the bed of the river, for the pile of drift goes clear to the bottom. The displacement of this pile cap was corrected by merely moving the dowel blocks to place the runways in line again.

The second flood of sufficient magnitude to take out the bridge occurred August 31, 1912. Traffic at this time was interrupted for only forty-two hours, and this period could have been cut down considerably had sufficient labor been available. Drift piled up as before but no further displacement of the pile bents was noticed.

UNIT COSTS OF CONSTRUCTION.

By A. H. SJOVALL, Assistant Engineer, Statistical Division.

ALBAY PROVINCE.

ALBAY-AMBOS CAMARINES INTERPROVINCIAL ROAD.

Nearly 10 kilometers of the Albay-Ambos Camarines interprovincial road were graded and surfaced between March, 1911, and May, 1912. This section of road together with 18 bridges and culverts cost some ₱105,000, exclusive of Bureau surcharge. Three-fourths of this amount was spent for grading and surfacing. The job involved over 61,000 cubic meters of earthwork and 6,500 cubic meters of crushed and broken stone. The surfacing is 3 meters wide with 1 meter shoulders.

The cost figures which follow have been compiled from data collected by assistant engineers on the job. The data submitted bear every mark of accuracy and completeness and may be taken as reliable. The different conditions under which the several sections of the work were carried on and the resulting differences in unit costs should prove of interest to engineers in general.

The earthwork done naturally divides itself according to the class of materials moved, into three sections, viz, (a) kilometers 42 to 44 inclusive; (b) kilometers 45 to 46, inclusive; (c) kilometers 47 to 51, inclusive.

Sections.	Quantity moved.		Mean unit cost.	Mean distance moved.	Remarks.
	Amount.	Character.			
Kilometers 42 to 44.	13,319	Sandy loam	₱0.54	15	Moved by administration. All wheelbarrow work.
Kilometers 45 to 46.	20,985	Alluvial soil wet.	.49	394	Kilometer 45; 5,360 cubic meters let by contract at ₱0.30 per cubic meter. Contractor lost money and abandoned the work which was finished by administration. Kilometer 46; 15,625 cubic meters let by contract, at ₱0.40 per cubic meter. Moved by tramway; mean haul, 557 meters.
Kilometers 47 to 51.	26,735		.88	52	Sticky and hard to handle. All this moved by administration. All short hauls. Wheelbarrows used except for part of kilometer 47 where tramway was used.
Total (42 to 51.)	61,039		.673	162	

None of the subgrade was compacted in layers by roller. On kilometers 42 to 47, inclusive, the finished grade was rolled preparatory to placing metalling. On the other kilometers practically no subgrade was rolled.

Evidently considerable advantage was gained by the Government in letting the work in kilometers 45 and 46 by contract. The above unit cost for this section includes depreciation of tools loaned to contractor free of charge as well as the district engineering charges. The consequent cost of the work in kilometer 46 was only a shade below ₱0.50 per cubic meter but still probably represents a small margin of profit for the contractor.

The surfacing material for the job was from three sources as per the accompanying sketch.

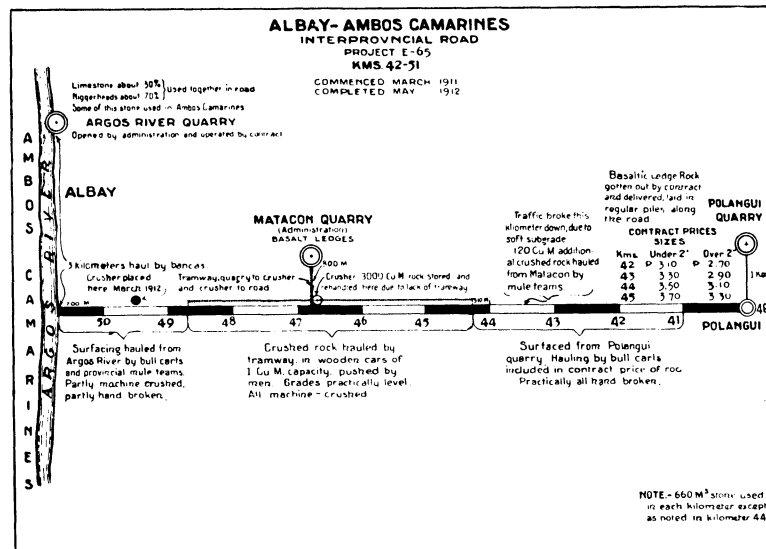


Plate 1.

The work naturally divides itself into three corresponding sections, viz:

	Surfacing material.		Mean haul.	Remarks.
	Quantity.	Cost.		
Kilometers 42 to 44, inclusive.	Cu. m. 2,108	₱6.07	Km. 3.6	Surfaced with basaltic rock from Polangui quarry, gotten out and delivered in regular piles on road by contract. Nearly all rock hand broken by administration.
Kilometers 45 to 49, inclusive.	3,308	5.86	2.2	Surfaced with machine broken basaltic ledge rock from Matacon quarry; quarried, crushed and placed by administration. All hauling by rented tramway.
Kilometers 50 to 51, inclusive.	1,120	4.90	3.8	Surfaced with a mixture of limestone and niggerheads from quarry at Argos river, hauled three kilometers to road by bancas and nearly all broken by hand. Hauled to road by carts and teams.
Total	6,536			
Average		5.77	2.93	

All the surfacing was rolled with a 10-ton steam roller. No binder was used except a thin layer of sand.

This project affords especial opportunities for comparison of costs of work produced by men and by machinery. Machine crushing versus hand breaking, for instance may be summed up as follows:

	Quantity.	Cost.	Cost per cubic meter.
	Cu. m.		
Crushed by machinery	4,176	₱5,999	₱1.43
Broken by hand	3,864	3,596	.93

Depreciation was charged on cost of engine and crusher as 3 per cent per month, amounting to ₱0.155 per cubic meter of stone handled.

All the stone broken by hand was first spalled to a 10-centimeter size. About one-half of it was then broken to 4 to 5 centimeter size for the top course. The fact that one-half of the hand-broken stone remained of the 10-centimeter size accounts for a portion of the difference in the cost of machine and hand-broken stone. Also the long haul of 50 kilometers from Legaspi increased the original cost of the crushing plant in place as well as the unit value of the coal used as fuel.

The total length of tramway available for use on the surfacing was about 2,400 lineal meters. Some 1,500 meters of this was laid in the quarry at Matacon and from the quarry to crusher plant at kilometer 47. The result was that the crushed rock could not be hauled directly to the road but had to be stored, to be rehandled later when tramway became available. In this way over 2,000 cubic meters of stone were handled twice, moved a mean distance of 1.16 kilometers each time at a cost of ₱1.09 per kilometer-meter. This cost, compared with the contract price for hauling by bull carts from Polangui at the rate of ₱0.20 per kilometer-meter, may be taken to indicate the relative disadvantage of tramway for short hauls.

Note.—Average daily rate for labor, ₱0.60; average daily rate for bull cart and driver, ₱2; daily rate allowed for provincial mule team and driver, ₱5; tramway was paid for at the rate of ₱1 per day per kilometer of track and ₱0.25 per day per car. No rental was paid while tramway was not in use.

CAPIZ PROVINCE.

DAO-MAMBUSAO ROAD.

Some 11½ kilometers of first-class road connecting the municipalities of Mambusao and Sigma with the Philippine Railway at Dao were constructed in Capiz Province between January, 1911, and June, 1912. A 3-meter surfacing was built with 1-meter shoulders. The job involved 27,500 cubic meters of grading and 6,200 cubic meters of stone and gravel. The total expenditure for grading and surfacing on the project was something over ₱40,000. Unit costs obtained from data submitted by the district engineer on various features of the work are given below.

Grading.—The earthwork averaged 2,400 cubic meters per kilometer of road.

This section of Capiz is level rice land and grading work presented no especial difficulties; some of the earth was loosened by means of plows and all was moved to the road with shovels and wheelbarrows. The work on the Dao end of the road on kilometers 30 and 31 is an exception to this, however, as the work there consisted largely in widening old cuts through heavy clay. This together with the fact that the work was done in the rainy season was probably responsible for the higher costs, as indicated below.

Cost of earth work by kilometers follows:

	Cubic meters moved.	Cost per cubic meter.	Remarks.
Kilometer 30	2,471	₱0.77	Largely widening old clay cuts. Work done in rainy season, January to March 1911.
Kilometer 31	1,549	.61	
Kilometer 32	2,728	.54	
Kilometer 33	2,706	.54	Embankment through level rice land. Work done in dry season, April to September 1911.
Kilometer 34	2,288	.55	
Kilometer 35	2,192	.55	
Kilometer 36	1,985	.53	
Kilometer 37	2,885	.54	
Kilometer 38	2,117	.50	
Kilometer 39	2,126	.39	
Kilometer 40	2,021	.42	
Kilometer 41	2,430	.44	
Total (kilometers 30 to 40)	27,498	.533	None of this work was rolled.

Surfacing.—Kilometers 30 to 35, were surfaced with rock from a quarry near Panitan, 10 kilometers from Dao on the railroad. Practically all of this material was run through a Champion No. 4 crusher with rotary screen.

The quarry which consisted of ledges of hornblende pyroxenite of good wearing quality and excellent cementing value, was opened in September, 1910. The crusher was set up in December and commenced crushing in March, 1911. During March and April some 1,000 cubic

meters of rock were run through the crusher and shipped to Dao to be placed on kilometers 30, 31, and 32. But owing to lack of sufficient tramway at Dao, crushing had to be suspended until October when some 2,000 cubic meters of rock had accumulated in the quarry storage pile.

The crusher resumed operations in October and completed crushing in January. During this period and until March crushed rock was shipped regularly to Dao at an average transportation cost of ₱0.834 per cubic meter including cost of loading and unloading railroad cars. The railroad was short of cars, however, and it was necessary to unload same immediately at Dao and place the stone in storage piles, thus making one additional handling to get it loaded into tramcars for the road.

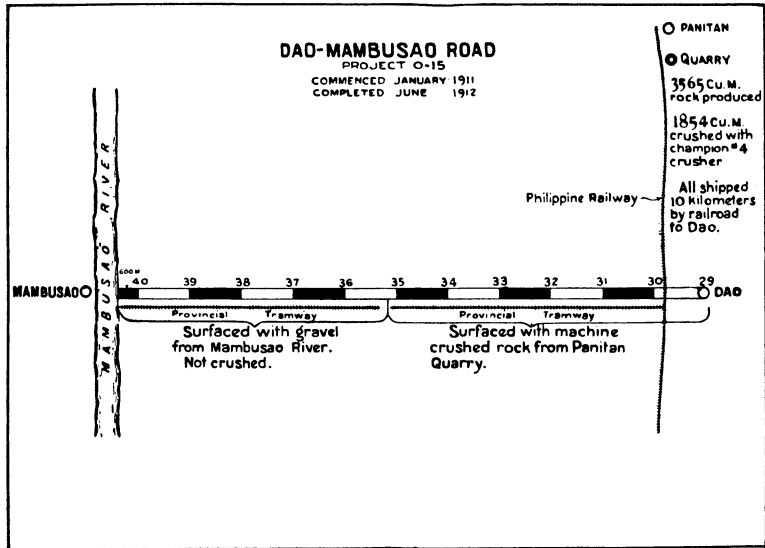


Plate 2.

The resulting costs for this section were as follows:

	Mean haul from Dao.	Quantity of rock measured loose.	Cost per cubic meter placed.
	Km.	Cu. m.	
Kilometer 30	0.25	463	₱5.27
Kilometer 31	1	498	5.60
Kilometer 32	2	566	7.65
Kilometer 33	3	513	4.82
Kilometer 34	4	550	6.13
Kilometer 35	5	541	5.51
Total (kilometers 30 to 35)	2.61	3,131	5.87

Kilometers 36 to 41, inclusive, were surfaced with a rather poor grade of gravel from the Mambusao River. There was enough fine stuff in the gravel so that it needed no crushing and compacted readily. All the material was hauled to the road over the tramway which was moved in December, 1911, to its new position.

The costs on this section were as follows:

	Mean haul from Mambusao River.	Quantity of gravel measured loose.	Cost per cubic meter placed.
	Km.	Cu. m.	
Kilometer 36	5.50	583	₱3.23
Kilometer 37	4.50	579	2.32
Kilometer 38	3.50	522	2.23
Kilometer 39	2.59	536	1.94
Kilometer 40	1.50	526	2.41
Kilometer 41	.50	528	1.73
Total (kilometers 36 to 41)	3.22	3,074	2.36

Demands for an immediate open road and lack of funds for constructing kilometers 36 to 41, inclusive, with crushed stone neces-

sitated the use of this poor grade gravel. Warrantable expenditure of even an average of ₱2.36 per cubic meter for this gravel in place is problematical and will remain so until the time for resurfacing is known and the relative costs of yearly maintenance on the two sections is had.

Quarry and crusher.—Some 3,160 cubic meters of rock (hornblende pyroxenite) were quarried by administration at a cost of ₱2.98 per cubic meter.

This was stored at quarry site and 2,723 cubic meters were hauled to crusher in wheelbarrows, and crushed, producing 3,094 cubic meters (11.3 per cent increase) of crushed rock at ₱1.36 per cubic meter, making a total cost for the crushed product at the quarry of ₱4.04. The cost was divided between quarrying, hauling, and crushing as follows:

Quarrying per cubic meter of crushed rock	₱2.98 : 1.113	₱2.68
Hauling in wheelbarrows, per cubic meter crushed		0.29
Crushing, per cubic meter produced		1.07
Total cost per cubic meter of crushed product at quarry		4.04

The cost of crushing includes depreciation of 2 per cent per month on cost of crusher and engine during time actually in use.

Tramway haul.—Six kilometers of 60-centimeter gauge tramway owned by the province was used for hauling surfacing materials. The track was first laid from Dao to kilometer 35, after the completion of which section it was moved and laid from Mambusao River to kilometer 36. Altogether some 5,000 cubic meters of rock and gravel were moved over the tramway a mean distance of 2.82 kilometers for ₱0.99 per cubic meter or ₱0.35 per kilometer-meter. This cost includes a depreciation charge of 2 per cent per month on the cost of tram and cars for the seven months in use.

NOTE.—Average daily rate for unskilled labor, ₱0.50; average daily rate for bull cart and driver, ₱2.50.

MANILA-SOUTH ROAD SYSTEM.

By H. F. CAMERON,
Associate Member, American Society of Civil Engineers.
Member of Philippine Engineering Society.

The comprehensive road system planned for the Island of Luzon, Philippine Islands, has for its initial point the monument that marks the center for the proposed capitol for the Philippine Islands in Manila, P. I.

This monument is located on Calle Nozaleda about midway between the Bagumbayan Drive and Calle Taft and the distances along the two trunk roads, the Manila-North and the Manila-South, are measured from this monument.

The Manila-South Road system, which this article is intended to cover, passes through Manila via Calle Real to Rizal Province in Pasay; thence to the Provinces of Laguna, Tayabas, Ambos Camarines, Albay, and Sorsogon to the municipality of Bulan on the San Bernardino Straits, a total distance of approximately 500 kilometers, of which 250 kilometers of the trunk line are now declared first-class construction while the remainder of the system is being constructed as rapidly as the means will permit.

A secondary or feeder system branches off from this trunk line that is designed to tap the entire agricultural and mining areas of the provinces which the trunk line has pierced, as well as the adjoining Provinces of Cavite and Batangas. The constructed part of this system will now allow through traffic from Manila to Atimonan on the Pacific Ocean in Tayabas Province, a distance of 178 kilometers, and through the major portion of Cavite and Batangas Provinces.

Justification for this projected system of roads may be seen when you know that the area of the country to be developed is 3,977,357 hectares, with a total population of 1,540,633. Of this vast area the Bureau of Agriculture, for the fiscal year 1911, reports 358,981 hectares as being under the cultivation of rice, coconuts, abacá, sugar, corn, and tobacco, which form the principal products. The amount

of these products grown for the year 1911 for these eight provinces is herewith tabulated for your information:

Crop features.	Unit.	Albay.	Ambos Camarines.	Batangas.
Rice:				
Area cultivated	Hectares	4,803	37,982	23,118
Rough rice grown	Kilos	4,082,936	29,286,913	7,924,083
Average grown per hectare	do	850.08	771.07	342.77
Same rough rice cleaned	do	2,658,656	19,070,548	5,159,868
Average cleaned rice grown	Hectares	553.54	502.09	223.20
Coconuts:				
Bearing trees	Number	4,083,043	1,743,366	134,919
Nuts gathered	do	56,274,463	24,806,331	381,589
Nuts used for food	do	8,571,987	3,373,311	68,089
Copra produced	Kilos	7,935,697	4,493,525	54,699
Coconut oil produced	Liters	133,265	172,185	
Tuba produced	do	1,627,190	389,807	
Abacá (Manila hemp):				
Area cultivated	Hectares	107,894	57,314	535
Abacá produced	Kilos	52,414,137	21,787,222	183,045
Average production per hectare	do	486	380	342
Sugar:				
Areas cultivated	Hectares	354	803	7,327
Weight of sugar grown	Kilos	157,999	331,493	15,194,358
Weight produced per hectare	do	446	412	2,074
Corn:				
Area cultivated	Hectares	1,554	605	7,454
Shell corn produced	Liters	505,050	266,925	2,868,075
Production per hectare	do	325	441	383
Tobacco:				
Area cultivated	Hectares			190
Amount of tobacco produced	Kilos			70,978
Average production per hectare	do			374

Crop features.	Unit.	Cavite.	Laguna.	Rizal.
Rice:				
Area cultivated	Hectares	17,363	23,527	23,330
Rough rice grown	Kilos	15,619,234	12,443,383	26,457,470
Average grown per hectare	do	899.57	528.90	1,134.05
Same rough rice cleaned	do	10,170,664	8,102,668	17,228,120
Average cleaned rice grown	Hectares	1585.77	344.40	738.45
Coconuts:				
Bearing trees	Number	63,082	5,067,027	
Nuts gathered	do	432,310	151,814,250	
Nuts used for food	do	336,860	21,926,352	
Copra produced	Kilos	14,309	12,872,417	
Coconut oil produced	Liters		4,230,492	
Tuba produced	do		1,483,870	
Abacá (Manila hemp):				
Area cultivated	Hectares	4,910	1,689	
Abacá produced	Kilos	1,734,758	701,948	
Average production per hectare	do	353	416	
Sugar:				
Areas cultivated	Hectares	1,814	1,492	2,042
Weight of sugar grown	Kilos	2,940,493	1,894,274	3,634,155
Weight produced per hectare	do	1,621	1,269	1,780
Corn:				
Area cultivated	Hectares	1,966	659	1,807
Shell corn produced	Liters	955,575	618,375	798,600
Production per hectare	do	486	953	441
Tobacco:				
Area cultivated	Hectares	102		16
Amount of tobacco produced	Kilos	14,950		3,634
Average production per hectare	do	147		227

Crop features.	Unit.	Sorsogon.	Tayabas.	Total.
Rice:				
Area cultivated	Hectares	9,851	30,996	170,970
Rough rice grown	Kilos	6,136,960	19,951,140	122,902,119
Average grown per hectare	do	622.98	643.67	
Same rough rice cleaned	do	3,996,160	12,991,440	79,378,124
Average cleaned rice grown	Hectares	405.66	419.13	
Coconuts:				
Bearing trees	Number	1,565,442	6,730,317	19,387,196
Nuts gathered	do	47,353,346	173,272,108	454,334,397
Nuts used for food	do	8,419,608	17,054,602	59,750,809
Copra produced	Kilos	5,364,947	25,921,837	56,657,431
Coconut oil produced	Liters	68,252	32,819	4,637,013
Tuba produced	do	582,809	653,868	4,737,544
Abacá (Manila hemp):				
Area cultivated	Hectares	51,508	4,824	228,674
Abacá produced	Kilos	20,651,884	1,725,080	99,198,074
Average production per hectare	do	401	358	
Sugar:				
Areas cultivated	Hectares	652	1,291	15,775
Weight of sugar grown	Kilos	738,697	1,157,538	26,049,007
Weight produced per hectare	do	1,133	897	
Corn:				
Area cultivated	Hectares	1,682	963	16,690
Shell corn produced	Liters	771,450	487,275	7,271,325
Production per hectare	do	458	506	
Tobacco:				
Area cultivated	Hectares	149	452	907
Amount of tobacco produced	Kilos	35,420	162,426	287,408
Average production per hectare	do	238	359	

These statistics are compiled from the official reports submitted by the municipal presidents of the 22 municipalities in Albay, the

40 in Ambos Camarines, the 20 in Batangas, the 14 in Cavite, the 27 in Laguna, the 24 in Sorsogon, and the 30 in Tayabas Provinces.

Taking the following average prices for all grades:

Rice, per kilo	₱0.1148
Ripe coconuts, per kilo	0.03
Copra, per kilo	0.15
Coconut oil, per liter	0.30
Abaca, per kilo	0.16
Sugar, per kilo	0.10
Shelled corn, per kilo	0.06
Tobacco, per kilo	0.27

The valuation of the above products is ₱40,038,076.22. To this sum must be added a very considerable amount for coffee, cacao, citrus and other fruits that are raised in large quantities in some of the provinces.

Of the total area of these provinces this 40 million pesos valuation of annual crops grown represents a cultivation of only 9 per cent of the total available area. Assuming that 75 per cent of this total area is average agricultural land, there is a possible development project in sight that should give an annual return of 350 million pesos that is waiting for good roads and railroads to give transportation to the markets.

Besides the agricultural lands there are some extensive and valuable mineral and oil sections in this area. In Ambos Camarines there are 1,000 hectares of gold-bearing area and over 1,500 hectares of iron-ore deposits that are already known. In Albay the coal measures are estimated to have a 20-million tonnage, while in Tayabas there are indications of oil-bearing properties of large area.

The justification for a road construction that the Bureau of Public Works demands is based on the actual productive traffic available, the state of the agricultural development adjacent to the road, the nature and class of crops raised, etc. After data have been secured, a detailed estimate for the cost of constructing the road to an approved first-class standard is submitted by the district engineer for the approval of the Director of Public Works, together with a statement of the justified cost of such construction based on the following formulas:

- (1) Average daily traffic, one way, of vehicles.
- (2) Assumed value to users of the road for one kilometer, 2 centavos per day.
- (3) Total value of one kilometer of road to traffic per annum (360 days),
- (4) Estimated annual maintenance per annum,
- (5) Justified cost per kilometer.

The justified cost equals (1) multiply by (2), multiply by (3), minus (4), capitalized at 4 per cent and in the calculation above item (1) will be doubled before the multiplication. For example: If the traffic one way is 63 vehicles per day, both ways per day would equal 126 vehicles. This multiplied by 2 centavos gives the value of the road at ₱2.52 per day per kilometer; multiplying by 360 days would indicate a value of one kilometer of this road for one year of ₱907.20. This sum minus the estimated yearly maintenance, assumed to be ₱600, leaves ₱307.20 which, capitalized at 4 per cent would, with the traffic above shown, justify an expenditure of ₱7,680 per kilometer.

On this basis of computing the value of road construction to the travelling public, there had been completed and designated as first-class on June 30, 1912, 1,780 kilometers of road, distributed throughout thirty provinces. Over these roads the actual productive traffic, which has developed over the traffic upon which the actual cost of construction was based, has increased to, in some cases, 1,000 per cent. This increase in traffic represents largely increased agricultural products which are now finding their way to market, and once a road is thrown open to the public, in an agricultural district, the land is settled so rapidly by the people that the new traffic, which follows in the wake of the new land development, justifies a continuance of this road.

In the Manila-South Road system, there is no one standard cross-

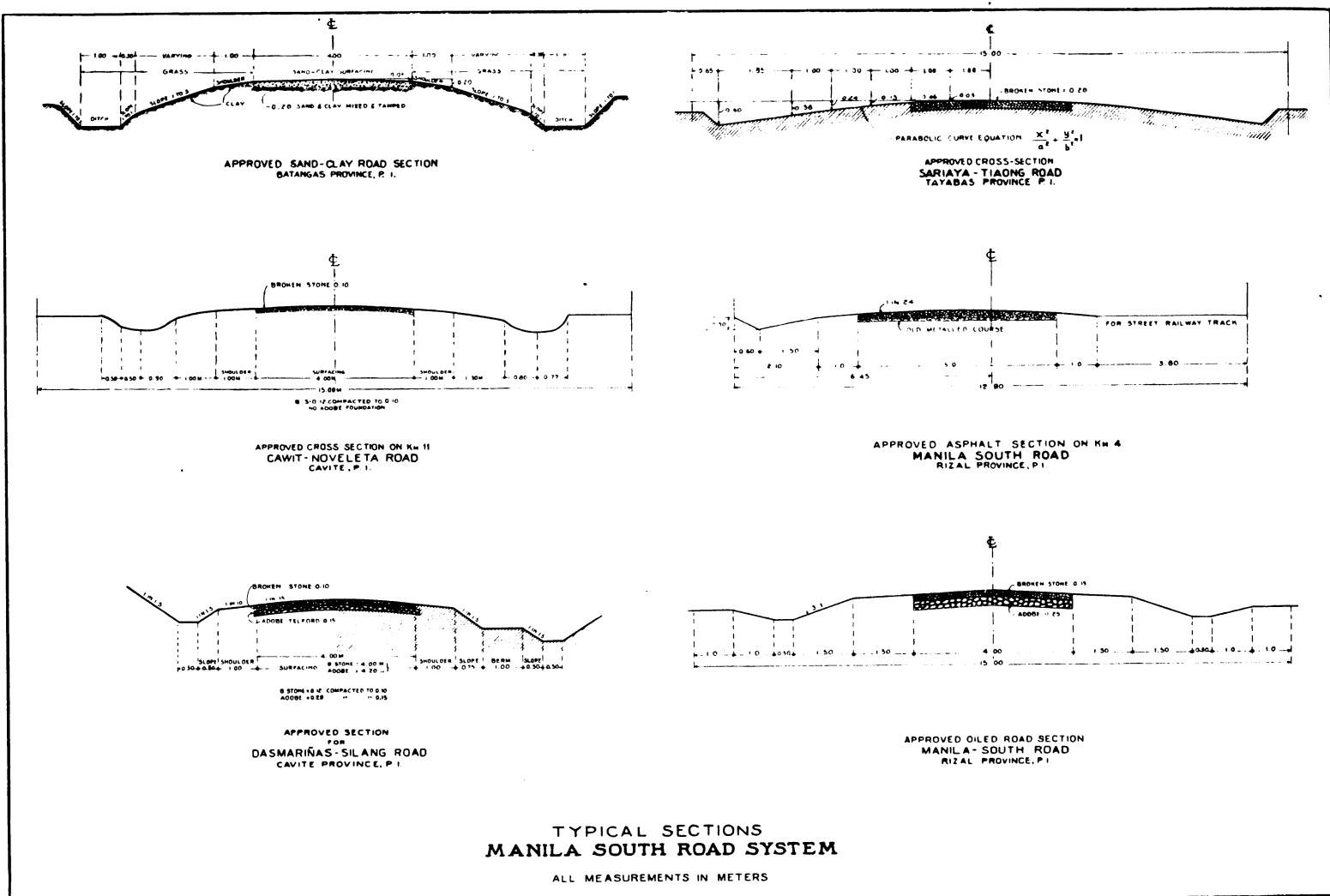


Plate No. 1.

section of road or bridge construction followed, as the geological and local conditions of transportation and labor change with each province entered. Accordingly you can find roads constructed in the different localities of this system with subgrades of dirt, adobe stone, coral, river boulders, or Telford, and with surfaces of sand and clay, finger coral, river gravel, broken stone, oiled macadam, or asphalt. These conditions apply also to the permanent bridge construction and in many places it is far cheaper to design and build bridges of adobe cut stone than to use the standard concrete designs of the Bureau of Public Works. This influence of local conditions on these constructions may be better understood by reference to Plate I showing approved road cross-sections for the Provinces of Rizal, Cavite, Batangas, and Tayabas, and to Plates 2 and 3 to show the modern construction as compared to the massive Spanish construction of adobe cut stone which is still found a cheaper construction in many localities.

In the southern part of Rizal Province and the adjacent section of Laguna Province and in the Provinces of Cavite and Batangas, the country stone is the adobe which comes to the surface. This stone is so soft that it is barred out in large pieces which are used broken for subgrade work and sawed or hewn with axes into standard stones of 20 by 20 by 50 centimeters for bridge or building work.

The river courses formed in this stone are deep, narrow gorges with maximum depths of a 100 meters and minimum widths of 15 meters.

Because of this geological condition for these provinces it has become necessary, where traffic conditions have dictated a change of road construction from adobe gravel to broken stone, to secure the broken stone from the several quarries located in or about the Laguna de Bay.

From these quarries the streets of the city of Manila and many of the provincial roads of Rizal and Laguna Provinces have received their supply of broken stone. For comparative purposes three of

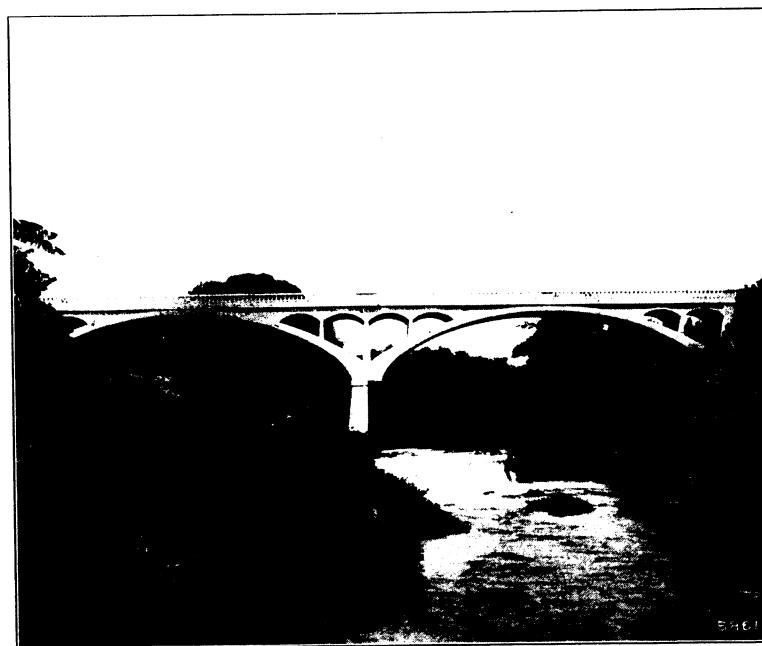


Plate No. 2. Vaughan Bridge, Calamba, Laguna Province—A type of modern bridge construction.



Plate No. 3. Spanish type of bridge construction, adobe stone.

the most common classifications of rocks found in and around Manila have been compared with the same rocks in the United States in the following tabulation:

Locality.	Class of rock.	Weight per cubic foot.	Absorption in water.	Percentage of wear.	French coefficient of wear.	Hardness.	Toughness.	Cementing value.
UNITED STATES.								
State of Washington ^a	Basalt	187	0.29	2.4	16.5	18.8	13	19
Do. ^a	do	175	0.27	3.2	12.5	16.8	15	500
Do. ^a	Andesite	181	0.17	3.2	12.6	18.8	21	176
Do. ^a	do	155	0.74	4.3	9.3	15.0	8	72
Do. ^a	Limestone	172	0.17	2.8	14.3	18.0	19	141
Do. ^a	do	172	0.30	6.6	6.1	17.0	5	40
State of California ^a	Basalt	168	1.69	4.0	10.0	18.6	18	119
Do. ^a	Andesite	172	0.83	2.2	17.9	17.7	29	500
Do. ^a	do	172	1.27	2.8	14.2	17.8	21	131
Do. ^a	do	156	2.04	4.7	8.4	10.4	8	500
PHILIPPINES.								
Los Baños, Quarry, Luzon, P. I. ^b	Basalt (Oct. 14, 1910).			5.5			6	3
Do. ^b	do			6.2			8	7
Do. ^b	Basalt (Feb. 24, 1912).			2.58				
Do. ^b	do			2.18				
Talim Island (Manila city quarry). ^c	do			2.57	15.52			
Do. ^c	do			8.66	4.62			
Angono, Rizal (new Manila city quarry). ^c	Gabbro			2.17				
Rizal Quarry Co. ^d	Basalt			1.7				18
Do. ^d	do			2.2				39
Do. ^d	do			2.7				39
Do. ^d	do			2.5				23
Baguio Road ^b	Limestone							79
Do. ^b	do							49
Lucena-Sariaya Road Tayabas. ^b	Andesite			4.68				
Taytay-Angono Road Rizal. ^b	do			2.4				

^a Bulletin 44, Bureau of Agriculture, Washington, D. C.

^b Bureau of Public Works requests.

^c Volume IV, No. 5, Philippine Journal of Science.

^d Bureau of Science, permission of Mr. Delmar-Smith-Clinton.

It is regretted that more complete tests cannot be obtained from the Bureau of Science, who are equipped with the same testing apparatus as the division of roads, Department of Agriculture, Washington, D. C., but the reason for this seems to be that the requestors for tests seemed not to have recognized the fact that there are other qualities about a road-building rock that are just as valuable, if not more so, than the abrasion test they request.

An explanation of the above tests, which were all made in accordance with the standard method of the road material laboratory of the United States Department of Agriculture, is an abstract from their Bulletin No. 44. They assume that the action of mechanical agents is by far more severe in causing the destruction of a road than either chemical or physical agents, and the ability of a rock to withstand mechanical destruction is of great influence in determining its value as a road-making material.

They state further that a road-building rock must have three very essential characteristics; it must be hard, it must be tough, and it must have good cementing or binding qualities.

By the hardness of a road material is meant its ability to resist the abrasive action of traffic in causing displacement of the surface particles by friction.

The toughness of a rock is a measure of its ability to resist rupture due to the impact of traffic.

The cementing or binding power of a rock determines how firmly the individual stones will be cemented together by the rock powder formed through the action of traffic.

In order to determine these three characteristics essential for a good road material, as well as to investigate other minor physical features, the following tests are made: (1) Hardness; (2) toughness; (3) resistance to wear; (4) cementing value; (5) specific gravity; (6) absorption.

(1) *Hardness*.—The hardness test consists in holding a cylindrical rock core 25 millimeters in diameter under a pressure of 1,250 grams perpendicular against a cast-steel disk revolving in a horizontal plane while standard quartz sand, between 30 and 40 mesh, is fed upon the disk to act as an abrasive agent. At the end of 1,000 revolutions the loss of weight is determined and the test repeated with the specimen reversed. The average loss of weight computed from the two runs is used in determining the hardness of the rock with the formula $\text{Hardness} = H = 20 - \frac{1}{4} W$, where W = loss in grams per 1,000 revolutions where 20 is an arbitrary constant selected with a view of giving results from this test the same range as the French coefficient of wear described under the abrasion test.

(2) *Toughness*.—The test for toughness consists of a 1-centimeter fall of a 2-kilogram hammer for the first blow and an increased fall of 1 centimeter for each succeeding blow, until failure of the test piece occurs. The number of blows to cause failure is used to represent the toughness. This impact test for toughness was adopted by the American Society for Testing Materials on August 15, 1908.

(3) *Resistance to wear*.—The abrasion test, as performed by the Deval abrasion machine, gives this determination and also tests for hardness as well as the toughness of the rock.

This machine consists essentially of four cast-cylinders, 20 centimeters in diameter and 34 centimeters in depth, inside measurements, mounted on a motor or belt driven shaft in such a way that the axes of the cylinders are inclined at an angle of 30° with the axis of rotation. The test sample for these cylinders consists of about 50 pieces of thoroughly dried rock of uniform size weighing within 10 grams of 5 kilograms. This rock passes through 10,000 revolutions at the rate of from 30 to 33 revolutions a minute. Only the percentage of material which will pass through a 0.16-centimeter ($\frac{1}{16}$ inch) mesh sieve is considered in determining the amount of wear. The amount of wear may be expressed in any of three ways:

1. Percentage of wear = $\frac{W}{5000}$, where W equals the weight in the detritus under 0.16 centimeter in size found from test of 5 kilograms. This coefficient may vary from 1 to 100.

2. French coefficient = $20 \times \frac{20}{W} = \frac{400}{W} = \frac{400}{W} = \frac{40}{\text{per cent of wear}}$ where W = weight in grams of the detritus under 0.16 centimeters in size per kilogram. This coefficient may vary from 0 to 20.

3. U. S. coefficient = $\frac{W-400}{10}$, where W equals the weight in grams of materials over 3 centimeters in size for a 500 gram test. This coefficient may vary from 1 to 100.

In this test the sample is thrown the length of the cylinder twice at each revolution so that the individual stones grind against each other, as well as against the sides of the cylinders. The rocks are likewise broken by impact, so that the abrasion test may be considered as one not only for hardness, but also for toughness.

(4) *Cementing value*.—The cementing value or binding power of a road material is the property possessed by rock dust or other finely divided material to act as a cement on the coarser fragments composing crushed stone or gravel roads.

The method of making this test is to place a half kilogram of rock sufficiently small to pass a one-half inch mesh screen in a ball mill having two cast-steel shots $2\frac{1}{2}$ inches in diameter with about 90 cubic centimeters of water sufficient to make a paste after grinding. Grinding is continued for two one-half hours at a rate of 2,000 revolutions an hour, after which the "dough" is removed and molded into cylindrical briquettes 25 millimeters in diameter and 25 millimeters high in a specially designed machine which in thirty seconds compresses the briquette so as to give a maximum pressure for an instant only of 132 kilos per square centimeter. After drying for twenty hours in air, four hours in a hot air bath of 200° F., and then cooling twenty minutes in a desiccator, the briquette is tested by a specially designed impact machine. The number of blows of a 1-

kilogram hammer under a 1-centimeter drop necessary to destroy the resilience of the briquette is taken to be the cementing value of the material.

(5) *Specific gravity*.—The specific gravity for a road rock is determined as follows: A small sample of rock weighing from 10 to 12 grams is weighed in air while held suspended from the balance by a fine silk thread. The specimen is then immersed in water and weighed immediately.

$$\text{The specific gravity} = \frac{W_a}{W_a - W_w}$$

Where W_a is the weight in air (in grams), and W_w is the weight in water (in grams).

From this result the weight of rock per cubic foot (solid) is obtained by multiplying the specific gravity by the weight of a cubic foot of water, 62.37 pounds.

(6) *Absorption*.—The absorption is obtained from the same sample of stone that is used for the specific gravity test by keeping it immersed in water four days until it has attained a constant weight. The absorption is expressed in pounds per cubic foot by the following formula:

$$A = \frac{W'w - Ww}{W_a - Ww} \times 62.37$$

Where A = the absorption.

W_a = weight of specimen in air (in grams)

Ww = weight of specimen in water when first immersed (in grams)

$W'w$ = weight of specimen in water after four days' immersion (in grams).

The interpretation of results of tests on road rock samples is herewith given:

Hardness.—Rocks having a coefficient of hardness below 14 are called soft; from 14 to 17, medium; and above 17, hard.

Toughness.—The results of the toughness test are interpreted so that rocks which run below 13 are called low; from 13 to 19, medium; and above 19, high.

Resistance to wear.—French coefficient of wear below 8 is called low; from 8 to 13, medium; from 14 to 20, high; and above 20, very high.

Cementing value.—Cementing values below 10 are called low; from 10 to 25, fair; from 26 to 75, good; from 76 to 100, very good; and above 100, excellent.

Absorption.—The principal value of this test is to judge the probable lasting qualities of the rock under the action of frost, which is not a factor in the Philippines. It has a value, however, in the bituminous-bound road construction now beginning in the Philippines. The use of a rock of high absorption rather than a rock of low absorptive qualities is desirable for this class of work. The result of observations would indicate that the bituminous material is taken in by the more porous rock and binds it together more efficiently than in the case of the less porous rock.

Experience has shown that in general the following table of limiting values for laboratory tests may be used in determining a sample's fitness for use on roads, if taken in connection with the conclusion drawn below under each heading:

Character of traffic.	Results of tests.		
	Percentage of wear.	Hardness.	Toughness.
Heavy	2.5 or less	18 or over	19 or over.
Medium	2.5 to 5	14 to 18	14 to 19.
Light	5 to 8	10 to 14	8 to 14.

The cementing value should in general run above 25 for all classes of traffic, except in specific cases.

The rocks with which we have to work on the Manila-South Road are not of a very excellent order for heavy traffic conditions as may be seen from the above tests. The 1,000 or more automobiles that speed over these outlying roads are the strongest factor in macadam or gravel road destruction, as the fast-moving wheels suck all the binding or cementing material from the broken-stone surface and eventually unravel this surface. The rubber tires do not have the power to wear the rock surface, like the steel tire, and be a factor in supplying the binding material for a macadam or gravel surface to replace that lost through this action and wind or rain, but are instead a destructive agent that is making the Bureau of Public Works experiment for even more durable types of road, and increased

durability, while maintaining the same surface standards, must necessarily be attended with increased cost.

During the past year the Bureau of Public Works has constructed two experimental pieces of road on the Manila-South Road; an asphalt section from kilometer 3.37 to kilometer 5.37, and an oiled macadam section from kilometer 15.30 to kilometer 30.5 with the exceptions of kilometers 20, which is a tangent, and 28, which has several curves, that were rock macadam construction and left unoled in order to compare the action of the same traffic over the different classes of construction. It is yet too early to speak authoritatively as to the final outcome, but it begins to appear as if justification for the construction of the oiled macadam would not be hard to find.

The average cost of roads per kilometer on the Manila-South Road System, based on actual construction experience in accordance with cross-sections shown on Plate 1, as compared with the average for roads construction in the Philippines, is as follows:

	Manila South Road system (surfacing, 5 meters).	Philippines (surfacing, 5 meters).
Sand and clay	P6,000	5,000
Gravel	9,000	7,500
Rock macadam	13,000	10,000

Ordinary culvert construction is included in these averages, but large bridge work is not. The right of way on all new roads is not less than 15 meters.

The oiling as applied to macadam surfaces will vary in cost from ₱0.20 to ₱0.25 a square meter of surface dependent upon the locality of the work. The asphalt surface will cost from ₱2.50 to ₱3 a square meter of surface dependent upon local conditions.

The grades on all new constructions planned for the Manila-South Road system are kept below 5 per cent. This grade, however, is greatly exceeded on the reconstructed portions of the road due to the fact that the old Spanish alignment has been used, it having been found too costly at this time, and the productive traffic did not demand it, to abandon these alignments to construct a road on an entirely new alignment or to cut down the old grades of Spanish days.

The present grades over 7 per cent with their length and location on the Manila-South Road, are herewith tabulated:

Kilometer—	Length of grade.	Grade.		Kilometer—	Length of grade.	Grade.	
	m.	P. ct.			m.	P. ct.	
9	15	13	Parañaque Bridge.	151	33	10	Atimonan Hill.
			Near Calamba.	151	60	10	Do.
57	20	7	Do.	151	33	10	Do.
57	40	11.3	Do.	151	27	8.5	Do.
57	20	10	Do.	151	18	9	Do.
57	40	7.5	Do.	151	24	10	Do.
58	100	9.2	Do.	151	36	10	Do.
58	20	8	Do.	152	57	9	Do.
80	20	13.5	Hills beyond Calauan to San Pablo.	152	15	8	Do.
			Do.	152	15	10	Do.
80	100	9.6	Do.	152	270	7.5	Do.
81	160	8	Do.	152	210	10	Do.
81	20	13.5	Do.	157	125	8	Do.
81	20	7	Do.	157	40	10	Do.
81	20	8.5	Do.	158	35	8	Do.
81	20	7	Do.	158	42	10	Do.
81	20	10	Do.	158	30	8	Do.
81	20	7	Do.	158	30	10	Do.
81	20	7	Do.	158	36	10	Do.
82	40	10.5	Do.	158	42	10	Do.
83	100	8.3	Do.	158	25	8	Do.
83	40	8	Do.	162	21	10	Do.
83	40	12.5	Do.	162	18	10	Do.
83	20	7	Do.	162	35	8	Do.
83	20	9.5	Do.	162	60	8	Do.
83	20	7	Do.	163	45	13	Do.
83	140	8	Do.	163	15	16	Do.
84	20	9	Do.	163	24	20	Do.
84	40	7	Do.	163	42	10	Do.
85	60	10	Do.	163	145	8	Do.
85	40	9.5	Do.	163	60	15	Do.
148	55	9	Do.	163	54	11	Do.
148	12	7.5	Do.	163	15	20	Do.
148	30	12	Do.	163	48	13	Do.
149	25	14	Do.	163	28	10	Do.
149	24	9	Do.	163	42	10	Do.
149	30	8	Do.	164	30	10	Do.
149	24	10	Do.	164	30	16	Do.
150	168	10	Do.	164	30	8	Do.
150	110	10	Do.	164	30	9	Do.
150	150	10	Do.	164	21	17	Do.
151	36	10	Do.	164	10	20	Do.
151	18	10	Do.	164	15	20	Do.
151	36	10	Do.	164	20	20	Do.

Present grades over 7 per cent—Continued.

Kilome- ter—	Length of grade.	Grade.	Kilome- ter—	Length of grade.	Grade.	
m.	P. ct.		m.	P. ct.		
164	15	9	Atimonan Hill.	166	30	8
164	15	20	Do.	166	30	14
164	30	11	Do.	166	30	10
164	30	10	Do.	166	90	10
164	80	8	Do.	166	30	8
164	35	9	Do.	166	18	13
164	42	10	Do.	166	30	8
164	36	10	Do.	166	30	9
164	30	11	Do.	166	10	17
164	45	9	Do.	167	16	20
164	36	16	Do.	167	36	12
164	30	10	Do.	167	30	8
164	36	20	Do.	167	30	9
164	18	10	Do.	167	30	8
164	25	12	Do.	167	33	9.5
164	30	20	Do.	167	12	20
164	21	17	Do.	167	30	12
164	30	9	Do.	167	30	12.5
164	45	10	Do.	167	30	8
164	9	20	Do.	167	30	12
164	25	14	Do.	167	12	20
165	60	20	Do.	167	60	10
165	30	9	Do.	167	30	9
165	30	16	Do.	167	18	12
165	30	16	Do.	167	24	7.5
165	30	15	Do.	167	6	20
165	30	15	Do.	167	30	7.5
165	30	20	Do.	167	60	10
165	30	15	Do.	167	30	13
165	30	9	Do.	167	30	14
165	30	19	Do.	167	30	9
165	30	16	Do.	167	30	16
165	30	10	Do.	167	30	9
165	30	8	Do.	168	30	7.5
165	30	12	Do.	168	120	8
165	15	12	Do.	168	30	14
165	15	10	Do.	168	60	16
165	30	9	Do.	168	33	12
165	15	20	Do.	168	30	8.5
165	15	20	Do.	168	30	14
165	30	10	Do.	168	30	9.5
165	30	15	Do.	170	30	7.5
165	30	13	Do.	170	30	8
165	30	9	Do.	170	30	7.5
165	15	8	Do.	170	30	7.5
165	30	9	Do.	171	20	8
165	30	8	Do.	173	10	10
166	60	14	Do.	173	30	8
166	30	12	Do.	179	15	8

For testing the climbing powers of an automobile the Atimonan Hill is recommended as good ground, there being little in the way of traffic to interfere with the tests.

For the sake of convenience a tabulation of distances from Manila to all points on the Manila-South Road system that are open for continual traffic from Manila is given. The distances between the municipalities shown on Plate 4 along the different roads and the road junctions are also given. On the Manila-South Road to Atimonan the distances shown are exact, while the other roads may be in slight error.

Manila-South Road—Rizal, Laguna, and Tayabas Provinces.

	Manila.	Parañaque.	Las Piñas.	Alabang.	S. P. Tunasan.	Biñang.	Santa Rosa.	Cabuyao.	Calamba.	Los Baños.	Bay.	Calauan.	San Pablo.	Tiaong.	Candelaria.	Sariaya.	Lucena.	Pagbilao.	Atimonan.
Manila	0																		
Parañaque	10	0																	
Las Piñas	13	3	0																
Alabang	25	15	12	0															
S. P. Tunasan	32	22	19	7	0														
Biñang	36	26	23	11	4	0													
Santa Rosa	41	31	28	16	9	5	0												
Cabuyao	46	36	33	21	14	10	5	0											
Calamba	56	46	43	31	24	20	15	10	0										
Los Baños	66	56	53	41	34	30	25	20	10	0									
Bay	73	63	60	48	41	37	32	27	17	7	0								
Calauan	78	68	65	53	46	42	37	32	22	12	5	0							
San Pablo	88	78	75	63	56	52	47	42	32	22	15	10	0						
Tiaong	102	92	89	77	70	66	61	56	46	36	29	24	14	0					
Candelaria	114	104	101	89	82	78	73	68	58	48	41	36	26	12	0				
Sariaya	126	116	113	101	94	90	85	80	70	60	53	48	38	24	12	0			
Lucena	138	128	125	113	106	102	97	92	82	72	65	60	50	36	24	12	0		
Pagbilao	147	137	134	122	115	111	106	101	91	81	74	69	59	45	33	21	9	0	
Atimonan	179	169	166	154	147	143	138	133	123	113	106	101	91	77	65	53	41	32	0

Batangas Road—Batangas Province.

	Manila.	Parañaque.	Las Piñas.	Alabang.	S. P. Tunasan.	Biñang.	Santa Rosa.	Cabuyao.	Calamba Junction.	Santo Tomas.	Tanauan.	Lipa.	San José.	Batangas.	Bauan.	Taal.	Lemery.	Calaca.	Balayan.
Manila	0																		
Parañaque	10	0																	
Las Piñas	13	3	0																
Alabang	25	15	12	0															
S. P. Tunasan	32	22	19	7	0														
Biñang	36	26	23	11	4	0													
Santa Rosa	41	31	28	16	9	5	0												
Cabuyao	46	36	33	21	14	10	5	0											
Calamba Junction	55	45	42	30	23	19	14	9	0										
Santo Tomas	68	58	55	43	36	32	27	22	13	0									
Tanauan	71	61	58	46	39	35	30	25	16	8	0								
Lipa	87	77	74	62	55	51	46	41	32	19	16	0							
San José	100	90	87	75	68	64	59	54	45	32	29	13	0						
Batangas	115	105	102	90	83	79	74	69	60	47	44	38	15	0					
Bauan	122	112	109	97	90	86	81	76	67	54	51	35	22	7	0				
Taal	138	128	125	113	106	102	97	92	83	70	67	51	32	23	16	0			
Lemery	139	129	126	114	107	103	98	93	84	71	68	55	39	24	17	1	0		
Calaca	153	143	140	128	121	117	112	107	98	85	82	66	53	39	31	15	14	0	
Balayan	164	154	151	139	132	128	123	118	109	96	93	77	64	49	42	26	25	11	0

Silang Road—Cavite Province.

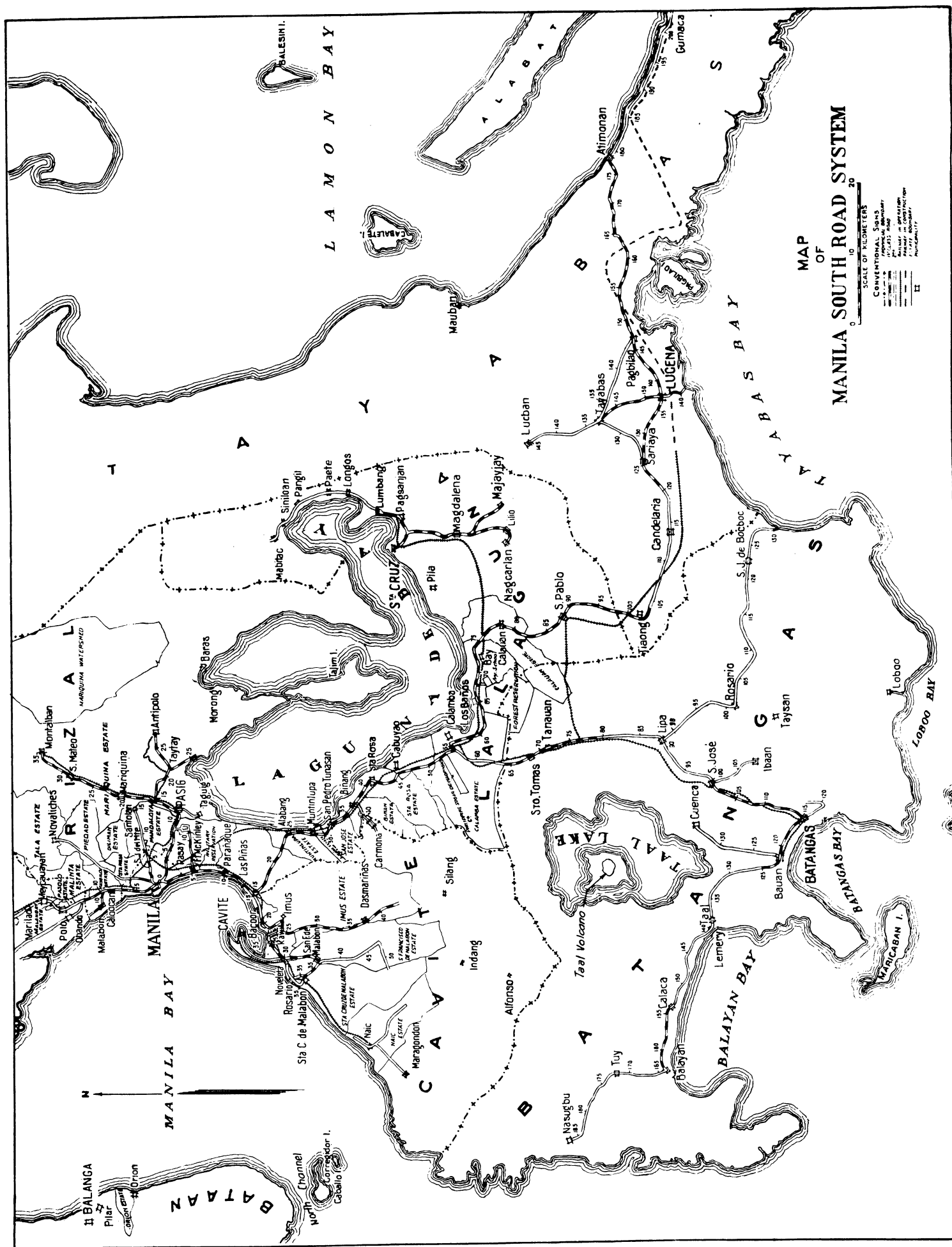
	Manila.	Parañaque.	Las Piñas.	Bacoor.	Imus.	Dasmariñas.	Silang.
Manila	0						
Parañaque	10	0					
Las Piñas	13	3	0				
Bacoor	18	8	5	0			
Imus	23	13	10	5	0		
Dasmariñas	37	27	24	14	6	0	
Silang	50	40	37	32	27	13	0

Cavite Road—Cavite Province.

	Manila.	Parañaque.	Las Piñas.	Bacoor.	Imus.	Binacayan.	Kawit.	Noveleta.	S. F. de Malabon.	Santa Cruz.
Manila	0									
Parañaque	10	0								
Las Piñas	13	3	0							
Bacoor	18	8	5	0						
Imus (Junction)	23	13	10	5	0					
Binacayan	26	16	13	8	3	0				
Kawit	27	17	14	9	4	1	0			
Noveleta	30	20	17	12	7	4	3	0		
S. F. de Malabon	36	26	23	18	13	10	9	6	0	
Santa Cruz	40	30	27	22	17	14	13	10		0

Antipolo Road—Rizal Province.

	Manila.	San Pedro Macati.	Fort McKinley.	Pasig.	Taytay.	Antipolo.
Manila	0					
San Pedro Macati	10	0				
Fort McKinley	12	2	0			
Pasig	15	5	3	0		
Taytay	22	12	10	6	0	
Antipolo	28	18	16	10	6	0



Montalban Road—Rizal Province.

	Manila.	San Pedro Macati.	Fort McKinley.	Pasig.	Antipolo Junction.	Mariquina.	San Mateo.	Montalban.
Manila	0							
San Pedro Macati	6	0						
Fort McKinley	9	3	0					
Pasig	12	6	3	0				
Antipolo Junction	15	9	6	3	0			
Mariquina	21	15	12	9	6	0		
San Mateo	29	23	20	17	14	8	0	
Montalban	35	29	26	23	20	14	6	0

The justification procedure, which is explained above and is based upon actual productive traffic, necessary to secure the approval of the Director of Public Works for a new road construction is a product of the new administration of public works in the Philippines. Under this policy there is an assured agricultural development throughout the Islands that has not been possible heretofore. Every road construction authorized under this policy will pay for itself from the beginning.

The road traffic records in the past have been without system and are of little value for comparative purposes.

The new system, however, cannot fail but furnish valuable information to future administrators of road polices, inasmuch as every road in the 31 Christian provinces will have at least a two weeks' continuous observation two or three times a year.

A tabulation of some of the 1912 returns from some of the provincial roads of the Manila-South Road system follows:

Provinces.	Road.	Kilometer—	Date of census.	Average number of vehicles per day.	Municipality.
Rizal	Manila-South	5	February, 1907	127	Pasay.
Do	do	5	May, 1912	1,318	Do.
Do	do	5	December, 1912	1,997	Do.
Laguna	do	34	do	139	S. P. Tunasan.
Do	do	72	do	154	Bay.
Do	do	83	do	136	S. Pablo (north)
Do	do	92	do	916	S. Pablo (south)
Tayabas	do	135	November, 1912	327	Lucena.
Do	do	147	October, 1912	49	Pagbilao (south)
Batangas	Batangas-Taal	121	December, 1912	641	Bauan.
Do	Batangas-Beach	116	do	888	Batangas.
Do	San José-Lipa	88	do	1,429	Lipa (south).
Cavite	Malabon-Santa Cruz		August, 1912	203	Malabon.
Do	Imus-Dasmariñas	25	do	239	Imus.

It is interesting to note the great increase in traffic on kilometer 5 of the Manila-South Road since the construction of the road out of Manila to the south. Similar results have occurred in other parts of the Islands. These tabulations, however, do not represent all the productive traffic that the road serves. Under American administration the small farmer has come into his own. The large Catholic Church holdings that were purchased by the Government a few years ago have been subdivided by the Bureau of Lands into small holdings, which are either sold or leased on long term periods with easy payments and without taxation during this period. The lands as a rule have been extensively cultivated in the past, and are, therefore, easy to put under cultivation again, which is a boon to the poor farmer. In all cases the original settler has been given the preference as property holder. Again the vast acreage of public domain that the new road system is making accessible to the markets offers opportunities to the poor, as it is open for homesteading. Many of the laborers upon the road construction take up sections and install their families thereon to make the small preliminary clearings while he earns the family support upon the road works.

The caminero system of road maintenance also affords the settler

a monthly stipend during his proving-up period. Probably 75 per cent of the small farmers that these liberal laws have developed during the last ten years are too poor to own a carabao or horse, so they till their lands with bolo and like implements. Of those that do own carabaos or horses 75 per cent are still too poor to invest in the ₱50 to ₱60 type of carabao cart wheels that are required by the law on the improved roads. Consequently the largest part of the productive traffic finds its way to market not by carts, but on the backs of the men,



Plate No. 5. Pack train of copra, Laguna Province.

women, and children, or pack trains of horses, as shown in Plate 5, or carabaos. During the vehicles census shown above on kilometers 83 and 92 of the Manila-South Road an average of 629 loaded pack animals entered San Pablo daily.

Where a man's daily wage on the farm is not considered worth more than ₱0.30 or ₱0.40 a day, you may find him and his family walking 40 or 50 kilometers to market with their hemp or copra, to save the carfare and heavy freight rates on the railroads that he otherwise would be obliged to pay, thereby gaining several days' wages for himself, while getting a little ahead to buy the ₱200 carabao and cart, that he eventually secures. In many of the provinces the old time "cacique" type of rich farmer is slowly getting poorer and disappearing, while the former serf or slave is seeing a prosperity and independence that he never hoped to enjoy under Spanish régime. It is the latter type to whom we must look for the agricultural development of the Philippines under the present labor laws, either by supplying the labor for the larger capitalized developments, or by his own individual efforts to make a home for himself.

There is another side to this road development that has more than passing interest to the multitude—the opportunity to get away from the scene of the daily grind; to enjoy the week end or holiday in the hills; at the medicinal baths; or among the scenic beauties and wonders that are within easy reach of all by train, carriage, or automobile from Manila. The Manila-South Road system cannot be surpassed in this respect by any one road or system of roads in the Philippines. The Manila-South trip to Atimonan, a distance of 178 kilometers shows practically every stage through which the Philippines have passed in its agricultural and kindred development. Leaving Manila one passes through the new country residence district and the beautiful grounds of the Manila Polo Club between Pasay and Parañaque. In Las Piñas there are the artificial fish ponds and salt beds which help supply Manila with these staple foodstuffs. Then through an avenue

of bamboo one enters the pasture lands of the Government experimental stock farm at Alabang; is whisked through sugar and rice fields out of Rizal Province into Laguna Province. The road through this province to Calauan, a distance of 78 kilometers from Manila, is principally rice country and very rich. Until recently this section belonged to the friar lands and is an instance of some of the fine estates formerly held by this religious body. It also is an excellent example of the extensive irrigation systems that were constructed by those in control to make the most of these agricultural lands. It is in this section between the highway and the southern foothills, before reaching Calamba, that the new sugar central known as the Calamba Sugar Estates Company is in progress of development. The present plans call for an installation of a plant for crushing 1,200 tons of cane in twenty-four hours, with provisions for doubling at a later date, and crushing is expected to begin in 1915.

At kilometer 65, in the municipality of Los Baños, a trail to the west takes one to the Los Baños Falls a distance of 1.3 kilometers from the road. A body of water ranging from 3 to 12 second-feet make a perpendicular fall of 28 meters which, with its setting of tropical forest, forms a most beautiful spectacle and one worth visiting. At the same stopping place on the highway about 50 meters from the road to the



Plate No. 6. Typical road in Laguna Province, kilometer 92—Manila-South Road.

west there is a public swimming pool that is very popular with the Los Baños residents and those stationed at Camp Eldridge.

Los Baños, distant 66 kilometers from Manila, is on Laguna Bay at the foot of Mount Maquiling. This municipality has been well known for years as a health resort on account of its hot mineral and vapor baths, and as the bottling place of Isuan. The United States military government has a large sanitarium here and there is also the large private Los Baños Sanitarium for all who wish such treatment. The charges at the latter are: Single room with meals ₱6 a day, or ₱35 a week; double room, ₱5 a day or ₱30 a week each. Hot and cold water shower baths free to guests at any time. Vapor and tub baths ₱1 per bath, and massage ₱1.

At kilometer 68.5 is the entrance to the Los Baños Agricultural College. From here there is an easy ascent to Mount Maquiling, about 1,200 meters above sea level, which has a well-defined dry crater. This view is well worth the trip but requires a whole day in which to make it.

From Calauan a foothill country is entered and rice and sugar cane gives way for the coconut, coffee, cacao, hemp, citrus and other fruits. This section of Laguna and Tayabas Provinces is probably the richest agricultural section of the Philippines to-day and for a scenic trip is one of the best. Some of these effects are shown on Plates 6 and 7. At kilometer 81 at an elevation of 110 meters above sea level a beautiful



Plate No. 7. Typical road in Tayabas Province—Manila-South Road.

view of the flat country around Los Baños and Bay is obtained, beyond which is the Laguna de Bay with the mountainous Island of Malahi in its center.

In and about San Pablo there are nine beautiful lakes of large extent formed in the craters of extinct volcanos. One of these lakes, only 300 meters distant from the municipal building in San Pablo, is known as Lake Sampaloc and is reproduced on Plate 8. The formation of this lake is explained in the following legend:

"LAKE SAMPALOC (SAN PABLO LAKE).

"A long time ago when but few lived here the place where the lake now is was land and covered with many trees.

"A very selfish old man lived here and had become rich from selling the fruit from the trees.

"One of the trees was a tamarind, which in Tagalog is called "sampiloc".

"This fine sampaloc tree grew in the center of the land and its fruits were very, very sweet and many people came to buy it.



Plate No. 8. Sampaloc Lake, San Pablo, Laguna Province.

"It was sometimes used for medicine for the sick.

"The owner became very rich for he charged much money for the fruit when he saw that many wished to buy. He became very greedy and selfish and would not give any fruit to only those who could pay for it.

"One day an old woman came to beg for some fruit for her son who was sick, but the old man refused to give and drove her from the field.

"The woman became very angry and lifted her right foot and brought it down with a curse upon the man and his property.

"Immediately the water began to come up and the land to sink. The old woman disappeared and the man was left struggling in the water; he was changed into a "sarena"—a half man half fish—and is still swimming around in the water, being still a terror to many of the old people.

"Since then this body of water has the name it now bears, 'Sampaloc Lake.'

Another one of these pretty lakes has the name of Lake "Palak-pakin" or Santa Catalina. The name may be explained by another interesting legend:

"LEGEND OF LAKE PALAK-PAKIN" OR SANTA CATALINA.

"Many years ago the people built their homes near this lake thinking that there would be many fish for food there, but strange to say they found none.

"The inhabitants kept on increasing and the question of food became a most perplexing question.

"One day a great storm came; thunder and lightning terrified the people and caused prayers to be said and the assistance of the Virgin was asked.

"Suddenly the storm stopped, the sun came out and shone brightly over all. To their great surprise they saw floating in the lake a tree with a golden Virgin standing on it.

"The Virgin was secured and from that time on many fish were to be found in the lake and their request for food had been answered.

"So the tree, which was a palak-pakin, gave the name to the lake.

"A few years later the friars ordered the people to celebrate the finding of the Virgin and later ordered it brought to the town; they obeyed but from that time on the fish began to disappear from the lake and until to-day but few may be found."

There is a crater lake, Dagatan, about one-half kilometer to the right or west of the Manila-South Road at 300 meters beyond Laguna kilometer post 52, say 83 kilometers from Manila. The lake is only about half a kilometer in diameter, is very nearly round, is very deep and has no outlet.

Lake Bunot, also a crater lake very similar to Sampaloc but smaller being about a mile in diameter is on the left of the Nagcarlan Road about 2.5 kilometers from the San Pablo Plaza. To reach this lake, proceed as if going to Lake Sampaloc, but take first street to right after leaving the church.

There are other crater lakes further out on Nagcarlan Road, notably Calibato just off the road to the right and Lakes Yambo and Pandan a kilometer to the left, about 8 kilometers from the plaza at San Pablo. These are all beautiful lakes and are accessible on foot or horseback. Later in the dry season it will be possible to reach them in autos.

The surfaces of all these lakes are at different elevations and all are 100 or more meters below the surrounding country, while coconut trees are planted from the water's edge up the slopes of the surrounding mountains.

Looking east from San Pablo are seen the mountains San Cristobal, height 1,520 meters above sea-level and Banajao, height 2,200 meters, both extinct volcanos with craters.

The San Pablo Hotel has good accommodations at ₱4 a day, and offers a fine vantage point from which to make these delightful trips.

The remaining 41 kilometers of the present Manila-South Road, from Lucena to Atimonan on the Pacific, forms the most exciting part of the trip, inasmuch as the last 20 kilometers crosses the coastal mountain range through a primeval tropical forest, that is passable only on a narrow roadway constructed principally with heavy grades and sharp curvature. Here one sees the wild hemp, rattan, ferns, palms, hanging vines, many varieties of Philippine timber, and many gorgeous birds. There is one magnificent view to the south and west out over the China Sea that is well worth the entire trip. From Manila and return this trip may be made in

a day with automobile by taking an early start; but is much more comfortable after a night at Los Baños or San Pablo, as there are no satisfactory hotel accommodations in Tayabas Province.

It can also be made by train to Candelaria and automobile to Atimonan, a seven-hour trip from Manila against a six-hour automobile trip. The only rough road on the entire trip is between Tiaong and Sariaya, a distance of 24 kilometers.

There are also several side trips from the Manila-South Road that are worthy of taking. Branching off the Manila-South Road after leaving Las Piñas, or 15 kilometers from Manila, you are soon in Cavite Province where there are two pretty trips open for sight-seers—one to Silang a distance of 50 kilometers and at an elevation of 300 meters above sea level; the other to Santa Cruz or Rosario, 40 kilometers from Manila, and central to the largest rice fields of the southern provinces.

From the Cavite-Rizal boundary there are 4 kilometers of rough road to Bacoor to begin the trip with. Then the road for the next 4 kilometers to Imus follows the banks of the bamboo bordered Imus River, affording a charming scenic effect. From Imus to the Julian Bridge was the scene of some very hard fighting during the late insurrection. At the latter bridge is a very pretty monument to Lieutenant Ward Cheney who was killed here. The new road from here to Dasmariñas winds alongside of a large irrigation ditch and is shaded for much of its length by the large mango trees that furnish Manila with the best examples of this fruit in the Islands. Between Dasmariñas and Silang the rich agricultural country is newly opened and much of it public domain free for homesteading. From several of the summits on this road there is an unobstructed view into Manila which is worthy of seeing, especially in the early night. Silang on account of its altitude and some famous medicinal springs, was once a popular hot weather resort to Manila residents and may become so again now that it is only one and a half hours from Manila. Good deer, hog, and bird shooting is to be had along the high plateau country to Indang. The highest priced hemp in the Philippines comes from these municipalities.

The road to Cavite branches to the south at Imus. At the mouth of the Kawit River between Binacayan and Kawit, giving an unobstructed view of the Cavite navy-yard and Manila, is situated the



Plate No. 9. Residence of General Emilio Aguinaldo, Cavite Province.

pretty home of General Emilio Aguinaldo shown in Plate 9, who commanded the Philippine forces during the last insurrection. From Noveleta to Malabon and Santa Cruz the bamboo and mango shaded road follows the curves of the Malabon River and passes an excellent specimen of a Spanish constructed gravity type of adobe stone irrigation dam which raises the river water 9 meters in elevation and forms the headworks to irrigate the entire surrounding rice country. Cavite Province is a beauty spot that should not be overlooked. A typical road section view is shown on Plate 10.

For the Batangas trip the Manila-South Road must be left at kilometer 55, a kilometer north of Calamba. The first 9 kilometers in Laguna Province to Vigaa Bridge, which passes you into Batangas, is a passable but rough road. Once into Batangas Province the road is excellent, except 20 kilometers of second-class road between Tanauan and San Jose, passing through Lipa. This road passes through the once famous coffee-growing country and the best and



Plate No. 10. A typical first-class road, Cavite Province.

Another method, saving a day, is to arrange with Mr. J. D. Ward for a personally conducted trip from Batangas and return for ₱20 a person. This rate includes all expenses for carromata hire, launch trip across the lake, camping on the island over night, and hotel accommodations in Batangas. Special rates will be made for large parties. This trip requires carromatas for 14 kilometers on the Bauan-Taal Road, thence 2 kilometers across the country to the lake, where private launch is taken. By this route the tourist arriving at Batangas on the noon train would spend the night on the island, climb the volcano the next morning, and return to Batangas in time to take the 2.54 p. m. train back to Manila.

Still another trip from the Manila-South Road, but not passable by road all the distance, is the Pagsanjan Fall trip. The road trip can be made to Los Baños where either the train or lake boat may be taken; to Pagsanjan by the former or to Santa Cruz by the latter method of travel, thence by carromata to Pagsanjan, an hour's trip. Here guide and boats may be secured from either the Rebella or the Pagsanjan Hotel people. Plate 12 shows the beautiful lotus of Laguna de Bay and Plate 13 shows how the coconuts are transported from Pagsanjan to Manila. This trip can easily be made in two days from Manila and return.

Two other trips from Manila on the same road for 15 kilometers are recommended—one to Montalban where is located the gravity dam that impounds the Manila water supply; the other to Antipolo.

The Montalban trip may be made by Paco and Santa Ana to



Plate No. 11. Taal Volcano, Batangas Province.

largest orange belt in the Islands. Batangas also ranks the other southern Luzon provinces in corn and sugar production, besides being the breeding ground of the fast Batangas ponies. Another important industry that Batangas has become noted for is the embroidery and Irish crochet work. Probably 90 per cent of the embroidery work of the Philippines is done here, and a sales agency has been opened in Batangas city for the sale of this class of work.

The most interesting feature to the sightseer or tourist is the Taal Volcano shown on Plate 11, rising out of Taal Lake. A very complete description of same can be obtained from the Philippine Journal of Science, Volume V, No. 2, dated March 10, 1910, and Volume VI, No. 2, dated April 1911.

Persons desiring to visit this volcano will do well to remember that the Volcano Hotel is no longer at Tanauan but has been removed to Batangas where accommodations may be had of Mr. T. D. Ward at ₱4 a day or ₱21 a week. The present method of making the trip is to go to Batangas by train and stay all night; thence to Taal and San Nicolas by carromata, a four to five hour trip at a cost of from ₱4 to ₱5 for two persons. From San Nicolas a banca can be bargained for, with a price ranging from ₱4 to ₱8, to make the two-hour trip to the volcano. Here from one to two hours may be spent before returning to Batangas for the night. This trip will necessitate leaving Paco Station at 11.28 a. m. or 3.33 p. m. one day and returning to Manila at 11.24 a. m. the second day after. By automobile, however, this round trip can be made in twenty hours' running time.

Plate No. 12. Lotus (*Melumbium speciosum*) [A pink water lily], Santa Cruz, Laguna de Bay, Laguna Province.

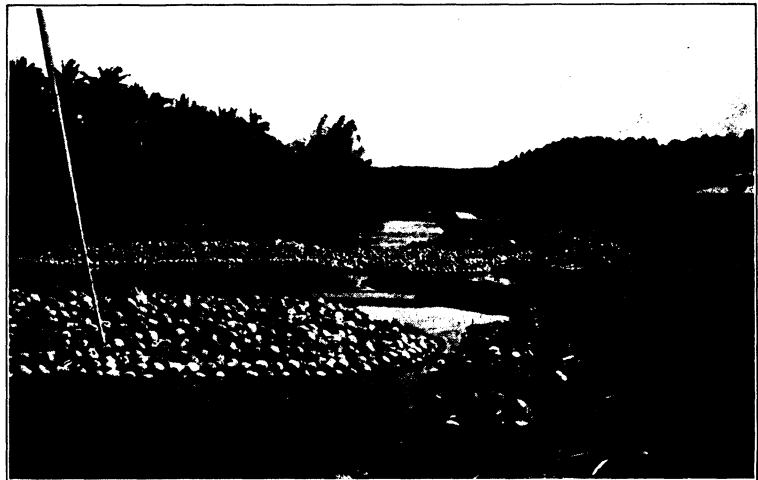


Plate No. 13. Coconut rafts bound for market, Pagsanjan, Laguna Province.

Pasig, or, of more interest, along the Manila-South Road to the junction of the Pasay-Fort McKinley Road at kilometer 5, thence by this road through the Fort McKinley military reservation to Pasig. From Pasig the road passes through extensive rice fields until it meets the Mariquina River, whose banks it follows to the foothills beyond Montalban. A walk of 300 meters after leaving your conveyance will take you to the dam. This trip out and return can easily be made in three hours by automobile.

At kilometer 15 of the Montalban Road the Antipolo Road makes a tangent for the foothills and begins the 250-meter climb for the Antipolo Hotel. Until the 1st of December, 1912, only the strongest automobiles could make the 18 and 20 per cent grades of these hills. Now, however, these grades have been cut to a $7\frac{1}{2}$ per cent maximum.

On this road may be seen the Antipolo waterfall or "Kinahulugan-Taktak" in Tagalog, by a ten minutes' walk from Taytay, either by Calle Salazar or walking back the railroad tracks from the station.

The Virgin of Antipolo is also of great interest to sightseers and at certain days Antipolo is the mecca for all the population of the surrounding country. The Virgin may be seen almost any day of the year by calling the sacristan at the church. A small gratuity is expected of the visitor.

The Tagbac cave is one hour's walk due east from Antipolo, and is well worth the trip and the trouble. Its exploration requires about forty minutes. Stalactic and stalagmitic formations are numerous, while the walls and ceiling are one solid mass of sparkling water crystals. Parties should be provided with candles or torches. Saddle horses may be engaged in Taytay at ₱2 each to take you from Antipolo to the cave and return.

There is an elevation on the road to Teresa and about forty minutes' walk from Antipolo, which is known as Tibagan, and which affords one of the grandest panoramic views in the Philippines. Portions of at least eight provinces are visible from this point.

The Antipolo Hotel is probably the best equipped hotel outside of Manila for coolness, comfort, and quiet.

The post-office and telegraph station is in the hotel building.

The rates are ₱6 a day, ₱35 a week, and ₱120 and up a month.

The map which forms part of this article is copied from a very accurate survey of the Bureau of Lands, and the location of the roads and the municipalities is correct.

The two legends published above are by the courtesy of Mr. Ernest Crowe, San Pablo.

Plates 5, 10, 11, and 12 are from official photographs taken by the Bureau of Science.

Any further information that at any time may be required of the Manila-South Road system will be cheerfully supplied by the provincial division of the Bureau of Public Works upon request.

THE ENGINEER.

Engineers must have characters above question. Millions are spent each year in the development of great undertakings, and the engineer's decisions may make or break a contractor. Remember that you are required to be the arbiter between two parties, and it is just as dishonest to make the contractor furnish more than the contract clearly calls for, as it is to allow him to do inferior work.

Character is the dominant factor in life. It is the only thing that leaves a permanent impression upon the men with whom you come in contact. Corporations and men of means are very careful as to whom they trust to spend their money, and unless your private life as well as your professional life will bear investigation, you will not gain the confidence necessary to enable you to reach the top of your profession.

It has been said that an engineer must be one-third mule to stand the work, one-third dog to stand the kicks, and one-third angel to keep cheerful, but I believe he only has to be all a man at all times.

To be a well rounded man you must take an interest in matters outside your calling. Take an active part in all the movements that are being carried on so nobly for the benefit of your fellowmen; be a leader in your community in religious and philanthropic work. Willingly give a portion of your time to help those who have not had your advantages. You will not find such time wasted, as it will prove as helpful to you as to those you are trying to help. Let us not be so engrossed with our wordly affairs that we forget that "the things which are seen are temporal, but the things which are not seen are eternal."

If you have faithfully lived up to your opportunities, and yet do not seem to make the progress you desire or deserve, don't be discouraged, and don't jump from one thing to another hoping that you will suddenly "hit it rich" by some lucky chance. To succeed you must know some one thing thoroughly, and this you cannot do if constantly changing, so select your calling and then stand by it, through hard times as well as good times, and eventually it will be known where an expert in your line can always be found. (Extract from the commencement address at the Rensselaer Polytechnic Institute by H. W. Hodge, of Boller, Hodge & Baird, consulting engineers, New York City.)

APPENDIX A.

CIRCULAR LETTERS ISSUED BY PROVINCIAL DIVISION FROM OCTOBER 1, TO DECEMBER 31, 1912.

MANILA, September 21, 1912.

Provincial Division Circular No. 77.

SIR: I have the honor to forward herewith one copy of the Report of the Philippine Commission for the fiscal year ending June 30, 1911. You are directed to place this on file in your office as part of the permanent office records.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

SEPTEMBER 24, 1912.

Provincial Division Circular No. 78.

SIR: I have the honor to direct that in the future all district engineers, assistant engineers, and other district employees with an Insular status, register the date of their arrival, the date of probable departure, and residence while in Manila. A register for this purpose will be kept in the office of the Chief Division Engineer, such employees reporting at the time of registration to the Chief Division Engineer in person. This registration must be effected immediately upon arrival in Manila and will be in lieu of the present requirements for registration with the chief clerk under Circular No. 137, dated January 13, 1908.

Failure to register as herein required may deprive the employee of allowances for traveling expenses, subsistence, and salary for the period while in Manila.

District engineers will furnish a copy of this circular to each employee of the district office having an Insular status and to such Insular employees as may be assigned to the district office in the future.

Very respectfully,

WARWICK GREENE,
Director of Public Works.
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

OCTOBER 10, 1912.

Provincial Division Circular No. 79.

SIR: I have the honor to invite your attention to a supply of Director's project reports, Forms Nos. 181 and 182, forwarded under separate cover.

Careful attention is invited to the instructions printed on the back of these forms and exact compliance with all current instructions in the accomplishment of these forms is directed. The forms should be made out in quintuplicate, the original, duplicate, and triplicate forwarded to the Manila office, the quadruplicate submitted to the provincial treasurer, and the quintuplicate retained as a permanent record in the office of the district engineer.

The submission of the revised Forms Nos. 181 and 182 forwarded under separate cover this date, should be accomplished for the month of October and succeeding months.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

OCTOBER 10, 1912.

Provincial Division Circular No. 80.

SIR: I have the honor to invite your attention to the attached Provincial Circular No. 256 of the Bureau of Audits, to request a

careful reading and direct an exact compliance with the provisions of the circular attached, with special reference to harmony and unity of action with the provincial treasurer. The circular in question is lucid and comprehensible, and its normal results should be a harmonious and exact administration of construction projects by and between the provincial treasurers and district engineers.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
BUREAU OF AUDITS.

MANILA, October 5, 1912.

Provincial Circular No. 256.

Provincial treasurers and district engineers:

1. All payments on provincial projects under the supervision of the Bureau of Public Works shall be made only upon vouchers approved by the district engineer, or such other person duly appointed to perform the duty usually required of the district engineer, or the representative of the district engineer duly appointed in writing. If such said representative approves such voucher it shall be his duty to immediately advise the district engineer in charge of the project of the approval of such voucher, giving identifying data of the voucher or vouchers approved.

2. It shall be the duty of the district engineer to keep an accurate account of all expenditures and obligations incurred under his supervision and he shall within five days after the end of the month make a report to the provincial treasurer of all expenditures made and obligations incurred. Said report shall show:

First, all certified expense of the preceding month carrying forward the balance theretofore certified expended on each project;

Secondly, said report shall show all contingent and estimated expense which may be included under the title of "obligations incurred." In this class shall be shown every sort of obligation by way of labor and material furnished, or contracted, which is or will be a charge against each project.

3. Upon receipt of such report from the district engineer and within ten days after the expiration of the preceding month the provincial treasurer shall submit to the district engineer a project statement showing:

First, total previously paid; and all vouchers paid during the month.

Secondly, all certified expenses shown by the report of the district engineer which have not been paid by the provincial treasurer, as accounts payable.

Third, he shall advise the district engineer of the net balance to the credit of each project after deducting from the appropriation or allotment therefor; total expense paid, total accounts payable, and the amount of the estimated obligations, as shown by the report of the district engineer.

Fourth, he shall advise the district engineer of the amount of available cash on hand for expenditure on each project coming under the supervision of the district engineer and shall also make an estimate of the amount of collections for the succeeding month. He shall also furnish the district engineer with such information at other times upon application of the district engineer.

4. Upon receipt of such statement, as above directed, made by the provincial treasurer to the district engineer, it shall be the duty of the district engineer to check the same with his accounts and should he find any discrepancy in such statement as compared with his own accounts of each project, he shall at once notify the provincial treasurer of such said discrepancy and their accounts must then be cross-checked so as to locate the discrepancy and to correct the same.

5. The district engineer and the provincial treasurer shall equally

be responsible for all overdrafts upon the moneys available for each project and coöperation of such officials is required.

6. The treasurer shall refuse to pay all vouchers which are in excess of the amount available for the project.

7. Should the district engineer, through his failing to comply with the rules and regulations now established or which may hereafter be promulgated, incur obligations in excess of the amount appropriated he shall be personally liable for the payment of such excess.

8. Should the provincial treasurer pay any vouchers the payment of which will create an overdraft he shall be personally liable for the amount of the overdraft thus created.

9. At the end of each fiscal year the district engineer shall make a report to the provincial treasurer of his operations for the entire year, as above directed, showing all accounts paid, all certified expenses, and all estimated expense. Within ten days after the receipt of such statement the provincial treasurer shall submit a project statement, as above directed, covering all projects for the entire fiscal year in the manner and form as directed for the monthly statement.

10. It is suggested to provincial boards that beginning with the ensuing fiscal year all appropriations for the maintenance of roads be made as follows:

First, that an appropriation be made for each road as a whole and not by sections, even though such a road may extend through a number of municipalities;

Secondly, it is deemed more desirable that one appropriation account be made for the maintenance of first class roads; one appropriation account be made for second and third class roads; and, if desirable to make a further subdivision, that one appropriation account be made for trails, which may be styled fourth-class roads. If the latter suggestion is accepted the district engineer shall submit a detailed monthly statement of the maintenance of such roads, according to classes, to the provincial board, showing the distribution of such road maintenance expenses in the provinces.

Respectfully submitted.

W. H. PHIPPS,
Insular Auditor.

Approved:

NEWTON W. GILBERT, *Acting Governor-General.*

MANILA, October 11, 1912.

Provincial Division Circular No. 81.

SIR: I have the honor to invite your attention to the attached list of structural and reinforcing steel in stock and on order at the Bureau of Supply. It should be noted that this list is dated October 4, 1912.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

OCTOBER 15, 1912.

Provincial Division Circular No. 82.

SIR: I have the honor to invite your attention to the attached Circular Letter No. 393 of the Bureau of Internal Revenue.

Special attention is invited to the provision that contractors who agree with Government officers only to *deliver* material are common carriers and should be taxed as such. As a result of this ruling local parties transporting gravel, sand, earth, or similar supplies for use on Government construction work, where such material is already the property of the Government and the transportation agreement forms an independent transaction, such parties then become common carriers and where the amount paid to such persons does not reach the sum of ₱500 per quarter payment of a common carrier's license tax is not required.

All district engineers are directed to offer every possible assistance to local internal-revenue collectors in requiring the registration of all parties as merchants, manufacturers, or common carriers, as defined in the attached circular letter. Unless it is apparent that the purchase of material from such persons will not reach the sum of ₱125 per quarter in the case of merchants or ₱500 per quarter in the case of common carriers, before entering into an agreement for supplies or transportation, the district engineer should require such parties to register in accordance with the provisions of the attached circular letter.

Very respectfully,

WARWICK GREENE,
Director of Public Works.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
BUREAU OF INTERNAL REVENUE,
OFFICE OF THE COLLECTOR.

Subject: Payment of Schedule C taxes by contractors.

MANILA, P. I., October 7, 1912.

Circular Letter No. 393.

To all internal-revenue officers:

The following definitions and explanations of the liability of contractors to Schedule C taxes are hereby promulgated for the information of all concerned:

"By virtue of the provisions of section 139, Act 1189, all persons, firms, or corporations who themselves or through others sell or manufacture for sale any merchandise unless specified as exempt, should have general merchants' or manufacturers' licenses paying an initial tax of ₱2 each therefor and should pay quarterly a tax of one-third of 1 per cent of the gross cash and credit sales on ₱125 per quarter or more by virtue of this Act, also persons who make a business of carrying the persons or goods of the public in general, except those subject to tax under the customs laws, are classed as common carriers for the purpose of taxation and each such person must have a common carrier's license, paying an initial fee of ₱2 therefor, and must pay the tax of 1 per cent of the gross receipts on ₱500 per quarter or more.

"Contractors who furnish labor only, except transportation, are not required to pay tax either as merchants, manufacturers, or common carriers. Contractors who furnish materials or both labor and materials must have general merchants' or manufacturers' licenses and must pay the percentage tax upon the gross amount received both in cash or credit for both labor and materials with no deductions for subcontracts. Subcontractors who furnish materials or both labor and materials must have general merchants' licenses and pay on the gross amount received, both cash and credit, for both labor and material.

"Contractors who furnish transportation for the completion of their own contracts are not common carriers, but if they furnish transportation for others they are common carriers and should pay the tax as such.

"Contractors who agree only to deliver material are common carriers and should be taxed as such; contractors who furnish materials as well as deliver the same, or who deliver materials not the property of the party for whom delivery is made but which become the property of such party after delivery and by virtue of delivery are merchants and are liable to taxation as such.

"Persons who agree with Government officers or employees in charge of public works to furnish transportation or construction materials, or other goods, wares, or merchandise for the Insular Government, or to undertake construction, at the same time furnishing materials, shall not be required to register as merchants, manufacturers, or common carriers if the amounts paid to such persons do not reach the sum of ₱125 per quarter in the case of merchants and manufacturers, or ₱500 per quarter in the case of common carriers: *Provided*, That if one such person, firm, or corporation so contracts for several persons and receives the total payment of said agreement, and later pays the others by subcontract or by wage, the liability to taxation of the person contracting shall depend on the total surpaid to him and not on his share after having paid those others for whom he contracted: *And provided further*, That if one such person so contracting has secured other contracts or is otherwise engaged in business as a merchant, manufacturer, or common carrier, he shall be required to hold the proper license and include in his statement of sales or receipts the amounts paid to him by the Insular, provincial, or municipal government.

(Sgd.) WM. T. NOLTING,
Collector of Internal Revenue.

MANILA, October 18, 1912.

Provincial Division Circular No. 83.

SIR: I have the honor to invite your attention to the attached copy of a sample provincial requisition for supplies. In the future all requisitions chargeable to a specific project prepared by the district engineer should show the estimated cost for each separate item on the face of the requisition and the amount correspondingly entered under "Obligations" on Form 251.

Requisitions for supplies, unless directions to the contrary appear on the face thereof, will continue to be filled by the Purchasing Agent regardless of the actual cost as compared with the estimated cost shown. As a rule requisitions call for stock supplies which may be estimated with a fair degree of accuracy by the district engineer, and the difference between the actual and estimated cost will not be such as to embarrass the financial status of the projects concerned. However, where special supplies are involved, such as doors, windows, iron-guards, patented roofs, articles requiring special manufacture, or

even hardwood lumber and similar supplies on which market quotations fluctuate to a large extent, the estimated cost at best will only be an approximation and consequently overdrafts may result.

As a safeguard against this condition it is suggested that district engineers secure a rubber stamp embodying directions to the Purchasing Agent as shown on the attached sample copy. *This stamp when used must appear on the last requisition sheet immediately above the certificate as shown in the sample.* Then if the Bureau of Supply price, including surcharges but excluding transportation, is more than 10 per cent in excess of the estimate for any one item as shown on the requisition and costing more than ₱50, the provincial treasurer must be notified of the cost of such item who, in turn, will notify the district engineer and the requisition may then be cancelled or the Purchasing Agent authorized to incur the additional obligation, in which case, the increased amount of the obligation must be immediately entered on Form No. 251.

Unless such directions appear on the face of the requisition the Purchasing Agent will continue to fill requisitions as in the past, the district engineer taking all responsibility for any overdraft that may result by reason of any excess in actual cost over the estimated cost for such supplies.

This requirement may seriously delay the filling of requisitions in some instances and should only be applied where financial embarrassment may otherwise result.

Very respectfully,

WARWICK GREENE,
Director of Public Works.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

OCTOBER 30, 1912.

Provincial Division Circular No. 84.

SIR: I have the honor to invite your attention to a supply of Bureau of Public Works Form No. 38, "Bridge data," forwarded under separate cover. An additional supply of these forms may be secured by regular requisition on the Bureau of Public Works.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

NOVEMBER 2, 1912.

Provincial Division Circular No. 85.

SIR: I have the honor to invite your attention to the "List of Rivers of the Philippine Islands," prepared by the division of port works, Bureau of Navigation, and supplied this Bureau by the Secretary of Commerce and Police for distribution. You are directed to place this list of rivers among the permanent records of your office.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

NOVEMBER 2, 1912.

Provincial Division Circular No. 86.

SIR: I have the honor to invite your attention to General Circular No. 77, of the Bureau of Audits. Copy attached for your information and files.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
BUREAU OF AUDITS.

General Circular No. 77. Subject: Travel expense.

MANILA, October 25, 1912.

The following is published for the information and guidance of all concerned:

"BUREAU OF AUDITS, September 13, 1912.

"Respectfully forwarded to His Excellency, the Governor-General. "It is believed that a fixed policy should be adopted whereby an

equitable adjustment of traveling expenses will be effected in the case of all employees who are prematurely separated from the service through physical disability not due to vicious or immoral habits.

"It is accordingly recommended that in all such cases the balance remaining due on account of expenses incurred by the Government be remitted. It is further recommended that in case the amount thus remitted is less than the amount derived from multiplying the fraction of proportional service by the amount which would be payable after two years, the difference be paid the employee. Thus if an employee is disabled after say eight months' service, the amount due him would be computed as follows:

Expenses advanced by Government	₱350.00
Expenses paid by employee en route	130.00
	<hr/> 480.00

"Eight twenty-fourth of ₱480 equals ₱160, amount earned by employee for proportional service.

"Amount deducted from employee's salary is ₱280, leaving ₱70 to be remitted.

"One hundred and sixty pesos less ₱70 equals ₱90, net amount due and payable to the employee.

(Sgd.) "W. H. PHIPPS,
"Insular Auditor."

"OFFICE OF THE GOVERNOR-GENERAL, October 18, 1912.

"The recommendation of the Insular Auditor of September 13 is approved. It is believed that notice of this ruling, which will be in force until the enactment of legislation to meet such cases, should be sent to all Bureaus and Offices.

(Sgd.) "NEWTON W. GILBERT,
"Acting Governor-General."

All payments made pursuant to the foregoing must bear the specific approval of the Governor-General.

(Sgd.) W. H. PHIPPS,
Insular Auditor.

Approved:

(Sgd.) NEWTON W. GILBERT,
Acting Governor-General.

MANILA, November 7, 1912.

Provincial Division Circular No. 87.

SIR: I have the honor to invite your attention to the attached "Rules Governing the Admission of Patients to the Philippine General Hospital, with List of Hospital Charges," and to inform you that these rules will govern in requesting admission for Bureau employees to the General Hospital in Manila.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

MANILA, November 19, 1912.

Provincial Division Circular No. 88.

SIR: I have the honor to invite your attention to the short time remaining before the close of the provincial fiscal year, ending December 31, 1912.

In the preparation of the provincial budget for the next fiscal year, perhaps the most important item will lie in properly providing for the maintenance of first-class roads. Heretofore the method of estimating for such maintenance has been devoid of any system and has either been approximated in round figures at so much per kilometer or has been based on the average cost of maintenance per kilometer for past years. Provincial boards have in turn provided an inadequate amount to cover the regular maintenance, ordinarily with an unrecorded understanding that should additional funds be required same would be made available. This has often resulted detrimentally to efficient road maintenance, a condition against which this Bureau must enter immediate protest.

On many of the roads traffic is increasing to such an extent that maintenance requirements are constantly increasing, a factor which should receive serious consideration in the preparation of maintenance estimates. Another important feature lies in the fact that under normal conditions metalled roads require resurfacing at in-

tervals of approximately five years, that being the ordinary age limit. This means that in most of the provinces estimates for maintenance should anticipate the resurfacing of such sections as were constructed prior to the year 1909 which have not already been resurfaced.

In the preparation of estimates for the maintenance of first-class roads for the fiscal year beginning January 1, 1913, and future years, district engineers will give due consideration to the special conditions herein enumerated in addition to the requirements of the regular maintenance organization, equipment and materials. Such estimate should be submitted to the provincial board in kilometer-section form after a careful and personal inspection of each section of first-class road in the district, with a request that the full amount thereof be set aside in the budget, the same to constitute one maintenance project for the maintenance of all first-class roads, as contemplated under Provincial Circular No. 256 of the Bureau of Audits, dated October 5, 1912. This estimate and recommendation should be submitted to the provincial board on or about December 1st of each year, one copy being immediately mailed to this Bureau. For the months of January and succeeding months the amount of this estimate should at all times appear on the Director's Project Reports. The district engineer must therefore assume the same responsibility for this estimate as attaches to estimates on construction projects, the maintenance organization being so perfected and the monthly expenditures so distributed as to fall well within the estimate, although the expenditures need not necessarily be limited to the amount estimated for any one kilometer or section. Should at any time unforeseen, unusual or emergency conditions arise necessitating an increase of the amount estimated and appropriated, the provincial board should be immediately advised thereof.

If it is contemplated, or deemed advisable, to do any improvement or construction work on any one section or kilometer of designated first-class roads, express authority with a special appropriation for such work must first be had from the provincial board. In the preparation of the estimate as herein directed provision should only be made for such maintenance as will be required to prevent deterioration, taking into consideration any apparent increase in traffic, probable change in the nature and class of the traffic and extra work ordinarily required as a result of heavy rains, ordinary droughts and common tropical conditions. It is not contemplated, however, that such estimate should provide for damages as a result of extraordinary floods or similar agencies.

In this connection attention is again invited to the fact that maintenance takes precedence over all construction work and that the district engineer must avail himself of all possible information to be had from the provincial treasurer on the available cash balance at all periods of the year, in order that public works may be so planned as to maintain a sufficient cash balance at all times to cover the necessary maintenance expenditures. Special stress is laid on the fact that the months of November, December, January, February and March represent a period of very limited revenue. A sufficient balance must, therefore, obtain at the beginning of this period to guarantee the uninterrupted maintenance expenditures until the beginning of the collection period in March of each year when the bulk of provincial revenue becomes available.

Very respectfully,

(Sgd.) WARWICK GREENE,
Director of Public Works.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

MANILA, November 20, 1912.

Provincial Division Circular No. 89.

SIR: I have the honor to direct that the following regulations be observed in requisitioning on this Bureau for repairs or spare parts of Government equipment.

Bureau of Public Works equipment for which repairs or spare parts are requisitioned, the Bureau number of such article or equipment must be clearly indicated on the face of the requisition, together with the manufacturer's number of the parts desired. No job number need be assigned.

Provincial or municipal equipment for which repairs or spare parts are requisitioned, the manufacturer's number must be clearly indicated on the face of the requisition, together with the job number against which the cost of the repairs or spare parts is to be charged.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

MANILA, November 20, 1912.

Provincial Division Circular No. 90.

SIR: I have the honor to invite your attention to Provincial Division Circular No. 264, of the Bureau of Audits. Copy attached for your information and files.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

BUREAU OF AUDITS

Subject: Bonding of district engineers.

MANILA, November 16, 1912.

Provincial Division Circular No. 264.

Provincial treasurers:

It has been held, under the present agreement between the provinces and the Bureau of Public Works as evidenced by the resolution passed by all provincial boards accepting the proposition of the Bureau of Public Works as to payments by the provinces to said Bureau, that the bond premiums of district engineers and their assistants are a proper charge against provincial funds, the same being a legitimate part of the local expenses of District Engineers' offices.

In view of the above ruling District Engineers and their assistants will, beginning January 1, 1913, be bonded by the provinces in the same manner as are provincial officials and employees, the same forms being used and the same rules governing in the premises, viz: Original personal applications for bonds will be made on Provincial Form No. 96; district engineers and their assistants will be included on "List of Officers", Treasury Form No. 36—Bond, submitted on January 1 of each year; all changes and bondings subsequent to January 1 of each year will be reported on Provincial Form No. 95 (A).

For the information of those who may be transferred before the expiration of the period for which premium has been paid, the following proviso of section 6 of Act 1739 is quoted:

"* * * premiums shall be due and payable semiannually in advance, and no refund of premiums so paid shall be made from the fund hereby created, but refund of unearned premiums shall be made to the officer or agent who has paid the same (a) upon retirement from the service, by his successor, or in case there is no successor from the appropriations or funds of the Bureau or Office concerned; (b) in cases where by reason of illness or other cause an acting officer or agent is appointed and bonded, from the appropriations or funds of the Bureau or Office concerned, the intent of this law being that two bonds shall not exist for the same office at the same time."

W. H. PHIPPS,
Insular Auditor.

MANILA, P. I., December 14, 1912.

Provincial Division Circular No. 91.

SIR: I have the honor to invite your attention to the attached Provincial Division Circular No. 270 of the Bureau of Audits, and to direct an exact compliance with its provisions.

The present system of project numbers as assigned by the district engineers with the letter designation as, for example, "MM-13" will be discontinued after December 31, 1912, and thereafter all project numbers will be assigned by the provincial treasurer, beginning with No. 1 and continuing in a consecutive series. The records, accounts, and reports of the district engineer will consequently bear this number alone. Such projects as remain active after January 1, 1913, will accordingly be reported under the new number, the district engineer entering the new project number on ledger Form No. 251 and the other records of his office immediately over the old number, the latter to be ruled out with red ink. Such projects, however, should ordinarily retain their original title which will necessitate an immediate understanding with the provincial treasurer in order that his assignment of project numbers and project titles may take into consideration the titles previously assigned to such projects. The old district engineer number, however, will be entirely eliminated thereafter.

Immediately after this arrangement has been definitely consummated the district engineer will submit to this Bureau a list of active projects on December 31, 1912, under their former title and project number, at the same time indicating the new title and project

number where the project remains active, or otherwise indicate that the project has been closed. The following form is suggested:

Project numbers—Rizal.

District engineer's designations prior to December 31, 1912.		District engineer and provincial treasurer new designation January 1, 1913.	
Title.	Project No.	Title.	Project No.
Construction Bocboc Bridge	MM-13	Construction Bocboc Bridge	1
Construction annex to Trade School	MM-27	Construction annex to Trade School	2
Construction Candijay Barrio School	MM-28	Construction Candijay Barrio School	3
Mangaldan collapsible deck bridge	a MM-29	Maintenance Loay Interior Road	4
Maintenance Taytay-Antipolo Road	a MM-45	Repair Sontua Bridge	5
Construction Laoag Barrio school	MM-46	Maintenance Loay Interior Road	6
Repair Sontua Bridge	a MM-47	Maintenance provincial capital	7
Maintenance Loay Interior Road	MM-72	Construction Calape Bridge	8
Maintenance provincial capital	MM-73	Maintenance first-class roads	
Construction Calape Bridge	MM-74		
Maintenance first-class roads	MM-75		
	to		
	MM-96		

^a Closed.

The provincial treasurer may find it advisable to arrange a convenient index showing the fund designations in connection with the project number. As this, however, does not affect the project designation nor project number, in so far as the district engineer's records are concerned, the fund designations will not be used by the district engineer.

An occasional project may be assigned by the provincial treasurer over which the district engineer exercises no supervision. The result of this will merely be that such project number will not appear in any part of the district engineer's records; in other words the district engineer's records will not necessarily show a title and project number for all consecutive numbers.

The advantages of the changes in accounting contemplated under Provincial Division Circular No. 270, together with the above instructions, will lie in the fact that the district engineer can then indicate on vouchers and other records the project number without reference to the title or any fund designation, this number standing for exactly the same project and account whether in the office of the provincial treasurer, the Insular auditor or any other branch of the Government service.

Special attention is invited to the fact that the letter designation preceding the project number for the various provinces has been abolished.

A separate list of active projects as heretofore required from the district engineer will no longer be submitted.

Provincial Division Circular No. 270 of the Bureau of Audits, contemplates that all projects coming under the supervision of the district engineer, whether provincial, municipal or otherwise, will have their numbers assigned by the provincial treasurer in consecutive order. For special projects coming under the supervision of the district engineer where disbursements are made directly by this Bureau, job numbers will in each case be assigned in the central office and will, therefore, be entirely independent of the project numbers, but recorded and reported under their job numbers.

Very respectfully,

WARWICK GREENE,
Director of Public Works.

To all DISTRICT ENGINEERS,
DIVISION ENGINEERS, and
PROVINCIAL TREASURERS in 31 regular provinces.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
BUREAU OF AUDITS.

Subject: Barrio school funds and project numbers.

Provincial Division Circular No. 270.

MANILA, December 6, 1912.

Provincial treasurers:

BARRIO SCHOOL FUNDS.

Before closing the provincial ledger on December 31, 1912, the remaining balances in barrio school funds—municipal ("P" accounts) will be transferred to and combined with the corresponding "O" fund accounts. This will be accomplished by black ink entries in both accounts, using as explanation, "Transfer of funds." This will, of course, result in bringing all funds for the construction of any one barrio school into one and the same account.

Thereafter, the municipal portion of funds turned over to the provincial treasurer for the construction of barrio schools will be taken up under Schedule O in the same account as the portion allotted by the Insular Government.

EXAMPLES.

The municipality of Candijay contributes ₱2,000 for the construction of a barrio school building.

Entry:
A-1; Cash ₱2,000
To 0-3; Candijay Barrio School Fund, Act — 2,000

Explanation: municipal contribution.

The Secretary of Public Instruction allots ₱4,000 for the construction of the same barrio school building in the Municipality of Candijay.

Entry:
A-1; Cash ₱4,000

or

A-2; Deposits, Insular Treasury ₱4,000
To 0-3; Candijay Barrio School Fund, Act — 4,000

Explanation: Aid from Insular Government, Act—.

Expenditures will be considered as having been made as follows:

First, from the municipal contribution.

Second, from the allotment.

Hereafter the Schedule "O" funds will be known as "Special disbursing fund" and the Schedule "U" accounts will be known as "Advances, Insular and special".

PROJECT DESIGNATIONS.

As of January 1, 1913, provincial treasurers will rearrange the project designations in their accounts in such manner as to provide a uniform series of project numbers, i. e., each project will be given its proper number in a consecutive series without reference to the account or accounts to which it may relate. The number thus given to a project will then be used in identification of the account or accounts pertaining to it and to none other.

In carrying out this system it will be necessary to keep a "Record of project numbers". It will probably be found advisable to use a bound book, suitably ruled for this purpose. The existing projects will first be entered in such order as is deemed expedient and numbered consecutively. Thereafter as new projects are provided for they will likewise be entered and numbered.

The distinction from the present method is that the projects will be numbered in the consecutive "order of projects" and not in the consecutive order of the accounts.

The following is a suggestion for the—

Record of project numbers.

Title.				Num- ber.
Construction Boc-Boc Bridge	K	E	C	1
Construction annex to Trade School		E	B	2
Construction Candijay Barrio school	O			3
Construction Laoag Barrio school	O			4
Maintenance Loay Interior Road			C	5
Maintenance provincial capital			B	6
Construction Calape Bridge	K	E		7

The main necessity for this record is to establish a proper series of project numbers. It may be arranged to serve also as a convenient index to the respective accounts by simply inserting the designation of each "fund" in which such accounts appear, as illustrated in the above example.

To illustrate further;

Let us assume that the Boc-Boc Bridge project was created by the annual budget with an appropriation of ₱20,000. Since it has been determined by the record of project numbers that it will be known as "Project No. 1", the following journal entry will be made:

C-Unappropriated ₱20,000
To C54-1; Construction Boc-Boc Bridge 20,000

The entry for the next project would be:

B-Unappropriated ₱5,000
To B53-2; Construction annex to Trade School 5,000
Project No. 3:
A-1; Cash 2,000
To 0-3; Candijay Barria School Fund, Act — 2,000

Proceeds of a loan are later received for aiding in the construction of the Boc-Boc Bridge.

Entry:
A-2 Deposits, Insular Treasury ₱5,000
To E-Unappropriated 5,000
E-Unappropriated 5,000
To E54-1; Construction Boc-Boc Bridge, Act — 5,000

Again, at a later date, funds are received to be taken up in the Insular Aid Fund for construction of the Boc-Boc Bridge.

Entry:	P7,000
A-2; Deposits, Insular Treasury.....	7,000
To K-Unappropriated.....	7,000
K-Unappropriated.....	7,000
To K54-1; Construction Boc-Boc Bridge, Act —	7,000

An Insular allotment for the construction of the Candijay Barrio School is received.

Entry:	P4,000
A-2; Deposits, Insular Treasury.....	4,000
To 3-0; Candijay Barrio School Fund, Act —	

It will be noted that the Boc-Boc Bridge project retains the number "1" in any and all accounts pertaining to it, and the Insular allotment for the Candijay Barrio School is credited to the same account and project as the municipal portion.

In rearranging the accounts in accordance with these instructions it will be necessary to rule up each account that assumes a new designation and carry the balance to a new ledger sheet. In each instance cross reference will be made between the old account and the new one by stating on the former "Transferred to account....." and on the latter, "Transferred from account....."

Special care should be exercised in carrying out these changes in order to avoid errors and confusion.

As soon as the projects existing on January 1, 1913, have been numbered as herein described, the provincial treasurer will promptly furnish the district engineer with a transcript of the record of project numbers and will thereafter furnish him with supplemental transcripts of all additions thereto as soon as entry has been made.

District engineers, or their representatives who have been authorized to approve vouchers covering expenditures on public works, are hereby required to designate the title and number of the project or projects to which such vouchers are chargeable, in accordance with the transcript of project numbers furnished under the provisions of the preceding paragraph. This will obviate any change for discrepancies resulting from misunderstandings as to projects and charges, and will make it entirely practicable for the provincial treasurer and district engineer to keep their records in accord.

(Sgd.) W. H. PHIPPS,
Insular Auditor.

Approved:
(Sgd.) NEWTON W. GILBERT,
Acting Governor-General.

MANILA, December 23, 1912.

Provincial Division Circular No. 92.

SIR: I have the honor to invite your attention to section 4 of Special Order No. 58, which provides that "skilled workmen, mechanics, or artisans whose rate of compensation is more than ₱720 per annum, ₱60 per month, or ₱2.40 per day, may be employed only on appointment under B. P. W. Form No. 3-A, approved by the Director of Public Works, etc.," a partial list of such positions being indicated in this special order.

Original appointments to any of these positions, or any other temporary appointment, with compensation exceeding ₱3 per day, ₱75 per month, or ₱900 per annum, will be disapproved by the Director except where special qualifications or extraordinary skill is involved, the only exception being in case of promotion appointments where the employee is already holding a similar position in the service. Where an original appointment is submitted at a rate of compensation

in excess of that herein indicated, same must be accompanied by a letter explaining in detail the educational qualifications and special training of the appointee for the position to be filled, and the necessity for such services. It is assumed for the most part that intelligent natives, trained in the service, are now available for filling the positions of skilled workmen as listed under Special Order No. 58. Other appointments will require substantial evidence of special qualifications and conditions before approval may be had.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

MANILA, December 26, 1912.

Provincial Division Circular No. 93.

SIR: I have the honor to invite your attention to the circular letter issued by the Special Agent of the Executive Bureau under date of October 15, 1912.

In submitting estimates for the construction of markets, upon which estimates the contractual award will be made, the percentage for contingent expenses should include the cost of inspection, unless it is possible for the inspection to be covered by the general district engineering expense surcharge, in which case special note should be made of this fact, and each item for contingencies, fill of site, etc., should be set out in detail.

Very respectfully,

WARWICK GREENE,
Director of Public Works,
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS, and
DIVISION ENGINEERS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
EXECUTIVE BUREAU.

Circular.

MANILA, October 15, 1912.

SIR: It is the policy of this office to request the Bureau of Public Works to advertise for one or more central buildings and several blocks of tiendas on market projects. The estimated value of the construction on which bids are requested will sometimes be in excess of the amount available for improvements at present. In advertising such projects it is the desire to get the most favorable bid to enable the municipality to make a selection of the tiendas and central buildings which it is considered advisable to construct. Treasurers should assist municipal councils to accept the most advantageous bids, but should avoid the mistake of permitting the acceptance of bids in excess of the amount available for market improvements. A sufficient amount should be reserved over and above bids accepted to provide for the provincial surcharge, as prevailing in the province at the time, 6 per cent surcharge of the Bureau of Public Works, an amount estimated by the District Engineer as sufficient for the necessary fill of site, and from 2 to 3 per cent for contingent expenses.

For the Executive Secretary:

W. W. BARCLAY,
Special Agent.

To all PROVINCIAL TREASURERS of regularly organized provinces.

APPENDIX B.

MOTOR VEHICLES REGISTERED AT THE BUREAU OF PUBLIC WORKS, MANILA, P. I., FROM AUGUST 16, 1912, TO DECEMBER 15, 1912, INCLUSIVE.

Registry No. and type.	Style.	Make.	Owner's name.	Owner's address.
1243. Automobile	Passenger	Hudson	Cecilio Lopez	429 Asuncion, Manila.
1244. Police patrol	Police patrol	White	Police department, city of Manila	Manila.
1245. Motor cycle	Passenger	F. N.	G. I. Gullen	Catbalogan, Samar.
1246. do	do	Indian	Juan Carrion	143 Aviles, Manila.
1247. Automobile	do	Buick	Miss Jacoba Paterno	453 San Roque, Manila.
1253. Motor cycle	do	Indian	Bureau of Agriculture	Manila.
1249. Automobile	do	Renault	Segunda Singson	Vigan, Ilocos Sur.
1250. do	do	Darracq	Levy Hermanos	C. o Estrella del Norte, Manila.
1251. do	do	Hudson	Paula Agoncillo de Tarnate	511 Sevilla, Manila.
1252. Truck	Truck	Cottreau	Jose Ribas	322 Echague, Manila.
1253. Motor cycle	Passenger	Indian	Bureau of Public Works	Manila.
1254. Automobile	do	Hudson	Roman P. Resurreccion	329 Ronquillo, Manila.
1255. Truck	Truck	Gramm	Cipriano Perez	La Carlota, Occidental Negros.
1256. Motor cycle	Passenger	Indian	H. O'Leary	Iloilo, Iloilo.
1257. Truck	Truck	Gramm	The Sanitary Steam Laundry Co.	Manila.
1258. Automobile	Passenger	Buick	Bureau of Public Works	Do.
1259. Motor cycle	do	Minneapolis	L. V. Macken	Bacacay, Albay.
1260. Automobile	do	Brasier	Felix M. Roxas	177 Valenzuela, Manila.
1261. Motor cycle	do	Indian	Vela Hermanos	Buhi, Ambos Camarines.
1262. Automobile	do	Pullman	A. J. Gibson	522 Nueva, Ermita, Manila.
1263. Truck	Truck	Delahaye	Luzon Brokerage Co	Manila.
1264. Automobile	Passenger	Maxwell	Filadelfo de Leon	Vigan, Ilocos Sur.
1265. Motor cycle	do	Indian	Bureau of Agriculture	Manila.
1266. Automobile	do	Abbett-Detroit	Harold M. Pitt	566 Nozaleda, Manila.
1267. Motor cycle	do	Indian	Bureau of Agriculture	Manila.
1268. Automobile	do	Hudson	Mercedes Javellana	Iloilo, Iloilo.
1269. do	do	Reo	C. L. Stone	448 Real, Ermita, Manila.
1270. Motor cycle	do	Indian	Bureau of Education	Manila.
1271. do	do	do	Province of Capiz	Capiz.
1272. Automobile	do	Krit	J. C. Howe	27 Wright, Manila.
1273. do	do	Chalmers	G. R. Mateo	6 Escolta, Manila.
1274. Motor cycle	do	Indian	Bureau of Agriculture	Manila.
1275. Automobile	do	Hupmobile	Rafael Machuca	184 Soler, Manila.
1276. Truck	Truck	Couple Gear	Quartermaster Dept., U. S. A	Manila.
1277. Motor cycle	Passenger	Indian	Bureau of Education	Do.
1278. Truck	Truck	Delahaye	Luzon Brokerage Co	Do.
1279. Motor cycle	Passenger	Indian	James Hickman	P. O. Box 1144, Manila.
1280. Automobile	do	Hudson	Santiago Ortega	622 Sacristia, Manila.
1281. Police patrol	Police patrol	White	Police Dept., city of Manila	Manila.
1282. Automobile	Passenger	Selden	Estanislao Manalo	Tarlac, Tarlac.
1283. do	do	Chalmers	Juan Martinez	Atimonan, Tayabas.
1284. Motor cycle	do	Indian	Province of Sorsogon	Sorsogon, Sorsogon.
1285. do	do	F. N.	A. L. Ammen	Nva. Caceres, Ambos Camarines.
1286. Automobile	do	Hupmobile	Lt. W. H. Smith	Ft. McKinley, Rizal.
1287. do	do	Packard	Capt. Chas. G. Fortimer	Do.
1288. do	do	Regal	Percy McDonnell Scott	Manila Hotel, Manila.
1289. Motor cycle	do	Indian	Carl B. Crabtree	Bacolod, Occidental Negros.
1290. Truck	Truck	Gramm	Max Blouse	Nueva Caceres, Ambos Camarines.
1291. Automobile	Passenger	Waverley	Francisco Gutierrez	827 Real, Malate, Manila.
1292. do	do	Maxwell	Felipe Gomez	Iloilo, Iloilo.
1293. Motor cycle	do	Indian	Clarence S. Gould	Guagua, Pampanga.
1294. Truck	Truck	Delahaye	M. A. Clarke	2 Escolta, Manila.
1295. Automobile	Passenger	Waverley	M. J. Osorio	43 Aviles, Manila.
1296. Motor cycle	do	Indian	Bureau of Agriculture	Manila.
1297. do	do	do	Stewart Teaze	C/o Bureau of Customs, Manila.
1298. do	do	F. N.	Walter J. Grodske, Jr	C/o Bureau of Public Works, Manila.
1299. do	do	Indian	Bureau of Constabulary	Manila.
1300. Automobile	do	R. C. H	U. G. McAlexander	Army & Navy Club, Manila.
1301. Motor cycle	do	Indian	E. C. Earle	1256 Leveriza, Manila.
1302. do	do	do	L. D. Gregg	La Carlota, Occidental Negros.
1303. Automobile	do	Delage	A. Broad	Zamboanga, Moro Province.
1304. do	do	Buick	L. O. Hibberd, P. P. John and F. Egeston	Baguio, Benguet.
1305. Motor cycle	do	Indian	Carroll E. Atwood	97 Rebellin, Manila.
1306. do	do	Phor	Alexander Mann	C/o Philippine Cold Stores, Manila.
1307. do	do	Indian	Bureau of Education	S. Isidro, Nueva Ecija.
1308. do	do	do	do	Do.
1309. Automobile	do	Ford	Brigida Enriquez	1267 Sande, Manila.
1310. Delivery wagon	Delivery wagon	Hupmobile	M. A. Clarke	2 Escolta, Manila.
1311. Motor cycle	Passenger	Phor	G. M. Harvey	112 S. Marcelino, Manila.
1312. Automobile	do	Chalmers	E. M. Bachrach	Manila.
1313. do	do	Hupmobile	Bureau of Navigation	Do.
1314. do	do	Clement Bayard	Carlos Pardo de Tavera	537 Raon, Manila.
1315. do	do	do	Victor Sevilla	21 Legaspi, Manila.
1316. do	do	Brazier	Fernando Zobel	165 M. de Comillas, Manila.
1317. do	do	Winton	Brebiary	Atimonan, Tayabas.
1318. do	do	Chalmers	Valentin Racela	Lucena, Tayabas.
1319. do	do	Hudson	Juan Ledesma	Jaro, Iloilo.
1320. Motor cycle	do	Belgian	Jose Ledesma	Do.
1321. Automobile	do	Delahaye	Cesar Ledesma	Silay, Occidental Negros.
1322. Motor cycle	do	Indian	William Daland	57 Nagtahan, Manila.
1323. Automobile	do	Buick	Isidro Nantes	Lucban, Tayabas.
1324. do	do	do	do	Do.
1325. do	do	Overland	J. Danon	206 Palacio, Manila.
1326. Motor cycle	do	M. M.	Arthur E. Haley	Hotel Oriente, Manila.
1327. Automobile	do	Chalmers	J. R. Barber	393 Nozaleda, Manila.
1328. do	do	Hudson	Bureau of Internal Revenue	Manila.
1329. Motor cycle	do	F. N.	J. F. Usry	Camp Gregg, Pangasinan.
1330. do	do	Indian	Bureau of Agriculture	Manila.
1331. Automobile	do	Reo	A. L. Vda. de Zamora	86 San Roque, Manila.
1332. do	do	Brazier	Milton E. Springer & Co	99 and 107 Plaza Sta. Cruz, Manila.
1333. do	do	E. M. F	Macleod & Company	Manila.
1334. Motor cycle	do	Indian	E. N. Woodbury	Fort Mills, Corregidor, Cavite.
1335. do	do	do	George Barnier	Pantal, Dagupan, Pangasinan.
1336. Automobile	do	R. C. H	Florencio Baltasar	1092 Arlegui, Manila.
1337. do	do	White	Province of Occidental Negros	Bacolod, Occidental Negros.
1338. Motor cycle	do	F. N.	Jose Ma. Lacson	Talisay, Occidental Negros.
1339. do	do	Indian	J. L. Myers	Mariquina, Rizal.
1340. Automobile	do	Overland	J. Damon	206 Palacio, Manila.
1341. do	do	White	City of Manila	Manila.

Motor vehicles registered at the Bureau of Public Works, Manila, P. I., from August 16, 1912, to December 15, 1912, inclusive—Continued.

Registry No. and type.	Style.	Make.	Owner's name.	Owner's address.
1342. Automobile	Passenger	Everitt	Herbert P. Linnell	10 Manga Ave., Manila.
1343. Motor cycle	do	Indian	Samar Province	Cathalogan, Samar.
1344. Automobile	do	Buick	Meliton Maniquiz	410 Constanica, Manila.
1345. do	do	Everitt	T. L. Donaldson	Fort McKinley, Rizal.
1346. Motor cycle	do	Belgian	Jose Jalbuena	Jaro, Iloilo.
1347. do	do	Aleyon	Daniel J. Grecia	Do.
1348. Automobile	do	Chalmers	Jose L. Molina	571 Peñafrancia, Manila.
1349. do	do	Hudson	Isidro L. Morales	13 Plaza Miranda, Manila.
1350. do	do	Oakland	J. Danon	206 Palacio, Manila.
1351. do	do	Renault	W. H. Williams	211 Barbosa, Manila.
1352. do	do	Chalmers	Vedasto N. Cadelina	Lukban, Tayabas.
1353. do	do	Hudson	S. Zaragoza	1030 S. Sebastian, Manila.
1354. do	do	R. C. H	Narciso Padilla	48 Rodriguez Hmos., Manila.
1355. Motor cycle	do	Indian	Frank E. Nichols	Bacolod, Occidental Negros.
1356. Automobile	do	Renault	Carmen A. Vda. de Roxas	239 Gral. Solano, Manila.
1357. do	do	do	Antonio R. Roxas	231 Gral. Solano, Manila.
1358. do	do	R. C. H	L. R. Jordan	105 Balmes, Manila.
1359. do	do	Buick	Philippine Assembly	148 Cabildo, Manila.
1360. do	do	R. C. H	M. E. Morris	Captain, Philippine Scouts, Manila.
1361. Motor cycle	do	Indian	Leopoldo Mirares	Bacolod, Occidental Negros.
1362. do	do	Sterling	Antonio Arriola y Luminato	617 Nozaleda, Manila.
1363. Automobile	do	Hudson	Jose Lopez	Jaro, Iloilo.
1364. do	do	Richard	Tomas Blanco	340 Palacio, Manila.
1365. do	do	Mitchell	Isabelo Devesa	Lukban, Tayabas.
1366. do	do	Ford	Jose Martin	272 Gipit, Manila.
1367. do	do	American	Vicente Tarnate	511 Sevilla, Manila.
1368. do	do	Metz	J. C. Graham	Los Baños, Laguna.
1369. Motor cycle	do	Indian	C. R. Gerber	M. O. D. No. 31 Cabildo, Manila.
1370. do	do	N. S. U.	Walter E. Hausheer	343 San Jacinto, Manila.
1371. do	do	Indian	R. F. Percival, P. C	Santolan Station, Rizal.
1372. Automobile	do	Mitchell	Aaron A. Algard	507 Sto. Sepulcro, Manila.
1373. Motor cycle	do	Indian	Bureau of Education	Bacolod, Occidental Negros.
1374. Tricycle	do	do	Province of Leyte	Tacloban, Leyte.
1375. Motor cycle	do	do	do	Do.
1376. do	do	do	do	Do.
1377. Automobile	do	Chalmers	Manuel Tioco	104 Villalobos, Manila.
1378. Motor cycle	do	Indian	Doty T. Jeter	C/o Police Dept., Manila.
1379. Truck	Truck	Panhard	Valentin Racela	Lucena, Tayabas, P. I.
1380. Automobile	Passenger	Chalmers	Saturnino Benito	San Nicolas, Cavite.
1381. do	do	Chalmers	A. A. Enriquez	Atimonan, Tayabas.
1382. Truck	Truck	White	Findlay, Miller Timber Co	1000 Valenzuela, Manila.
1383. Automobile	Passenger	Buick	Jose de Leon	125 P. Blanco, Manila.
1384. Motor cycle	do	Indian	Fred L. Martin	Capaz, Tarlac.
1385. Automobile	do	Flanders	Geo. K. Lewis	Vigan, Ilocos Sur.
1386. Motor cycle	do	Indian	J. M. Kerr	San Fernando, Pampanga.
1387. Truck	Truck	Berliet	Luis R. Yango	20th Century Bazar, Manila.
1388. Automobile	Passenger	American	E. H. Humphrey	Fort McKinley, Rizal.
1389. do	do	Reo	Casimiro Natividad	Nueva Caceres, Ambos Camarines.
1390. Delivery wagon	Delivery wagon	Ford	The Sanitary Steam Laundry Co	Manila.
1391. do	do	do	do	Do.
1392. do	do	do	do	Do.
1393. Automobile	Passenger	Overland	Bureau of Public Works	Do.
1394. Motor cycle	do	Indian	Bureau of Constabulary	Do.
1395. Delivery wagon	Delivery wagon	Ford	Enrique Rueda Lopez	115 S. Marcelino, Manila.
1396. Wagon	Delivery	American	Christian & Missionary Alliance	Zamboanga, Moro.
1397. Automobile	Passenger	Cadillac	F. W. Taylor	357 Nozaleda, Manila.
1398. do	do	R. C. H	Julio Ledesma	Jaro, Iloilo.
1399. do	do	Hupmobile	Bureau of Health	Manila.
1400. do	do	do	Bureau of Internal Revenue	Do.
1401. do	do	do	Department of Engineering and Public Works	Do.
1402. do	do	do	do	Do.
1403. do	do	do	do	Do.
1404. Motor cycle	do	Indian	Bureau of Agriculture	Do.
1405. Automobile	do	Hupmobile	Water Supply and Sewer Department	Do.
1406. Motor cycle	do	Pope	E. de Mitkiewicz	Angeles, Pampanga.
1407. Automobile	do	American	Chas. M. Bunker	Fort Santiago, Manila.
1408. do	do	Richard	Lee Rogers	Batangas, Batangas.
1409. Delivery	Wagon	Buick	Benardino Perez	Tanauan, Leyte.
1410. do	do	do	do	Do.
1411. do	do	do	Exequiel Gomez	Calbayog, Samar.
1412. Motor cycle	Passenger	Minneapolis	L. L. Bridenstine	Iloilo, Iloilo.
1413. Automobile	do	Overland	W. A. McVean	Los Baños, Laguna.
1414. Truck	Truck	Hewitt	Bureau of Public Works	Manila.
1415. do	do	do	do	Do.
1416. Motor cycle	Passenger	Harley-Davidson	A. J. Horswill	Nevada, Hotel, Manila.
1417. Automobile	do	Hotchkiss	Benjamin Mexie	International Banking Corporation, Manila.
1418. do	do	Brazier	Simeon Resurrección	628 Rizal Avenue, Manila.
1419. Truck	Truck	Sauer	Bureau of Public Works	Manila.
1420. do	do	do	do	Do.
1421. do	do	do	do	Do.
1422. Motor cycle	Passenger	German	Behn Meyer & Co. Ltd	Manila.
1423. Automobile	do	Chalmers	Gregorio Mañeru	Legaspi, Albay.
1424. do	do	White	Quartermaster Dept., U. S. A	Manila.
1425. Truck	Truck	do	do	Do.
1426. Automobile	Passenger	Renault	Teodoro R. Yango	81 Paz, Paco, Manila.
1427. Motor cycle	do	Pierce	William T. Roe	C/o Philippine Constabulary, Manila.
1428. do	do	Indian	Edward Ward	Cuartel de Infanteria, Manila.
1429. Automobile	do	Overland	Manuel Tioco	163 Pavia, Manila.
1430. Motor cycle	do	Iver-Johnson	F. M. Vanderveer	Manila E. R. R. and L. Co., Manila.
1431. do	do	do	J. G. Owen	Do.
1432. do	do	Indian	Bureau of Public Works	Manila.
1433. Ambulance	do	Commercial Truck Co	Bureau of Health	Do.
1434. do	do	do	do	Do.
1435. Motor cycle	do	Indian	Bureau of Constabulary	Bacolod, Occidental Negros.
1436. do	do	do	W. C. Clark	168 Lardizabal, Manila.
1437. Automobile	do	Hupmobile	Charles J. Calley	M. E. R. R. & L. Co., Manila.
1438. do	do	Chalmers	Pedro A. Enriquez	Atimonan, Tayabas.
1439. do	do	American	M. S. Bishop	1240 Real, Malate, Manila.
1440. Motor cycle	do	Indian	L. J. Williams 2nd Lt. P. S.	Guagua, Pampanga.
1441. Automobile	do	E. M. F.	Juan M. Paterno	367 San Sebastian, Manila.
1442. Motor cycle	do	Indian	Pampanga Province	S. Fernando, Pampanga.
1443. do	do	do	Eacott B. Miller	Dao, Capiz.
1444. Automobile	do	Hudson	H. B. Crosby	Fort McKinley, Rizal.
1445. Motor cycle	do	Indian	Bureau of Education	Tacloban, Leyte.
1446. Automobile	do	Packard	Soon Ho Lo	209 Sto. Cristo, Manila.
1447. Motor cycle	do	Indian	Jose A. Lacson	Talisay, Occidental Negros.
1448. Automobile	do	Chalmers	Jens Bugge	Fort McKinley, Rizal.
1449. do	do	Ford	Jose Macapinlac	72 Tuberias, Manila.
1450. do	do	Chalmers	Marcelo Capistrano	Tayabas, Tayabas.

* Canceled.

Motor vehicles registered at the Bureau of Public Works, Manila, P. I., from August 16, 1912, to December 15, 1912, inclusive—Continued.

Registry No. and type.	Style.	Make.	Owner's name.	Owner's address.
1451. Automobile	Passenger	Chalmers	Jose R. de Inchausti	501 Marina, Manila.
1452. do	do	Brush	W. F. Root	Vigan, Ilocos Sur.
1453. do	do	Maxwell	Ernest A. Kingcome	Guadalupe House, Cebu.
1454. Truck	Truck	White	Saturnino Benito	San Roque, Cavite.
1455. do	do	Gramm	do	Do.
1456. Automobile	Passenger	Overland	Rob't. F. Hyatt	Fort McKinley, Rizal.
1457. do	do	Pratt	Jack W. Heard	Do.
1458. do	do	White	Quartermaster Department, U. S. Army	Manila.
1459. do	do	Everitt	E. Block	Iloilo, Iloilo.
1460. Motor cycle	do	Indian	Wm. C. Younger	743 Globo de Oro, Manila.
1461. Automobile	do	C. M. C.	A. J. Dougherty	Camp Keithly, Moro Province.
1462. do	do	Gramm	M. L. Pert and F. D. Scott	Legaspi, Albay.
1463. Motor cycle	do	Indian	Province of Albay	Albay.
1464. Automobile	do	American	C. G. Chapman	Ft. McKinley, Rizal.
1465. do	do	Hupmobile	Mariano Lacson	Talisay, Occidental Negros.
1466. Motor cycle	do	M. M.	W. C. McGill	Calamba, Laguna.
1467. Automobile	do	Jackson	Hotel de Francia	Manila.
1468. do	do	do	do	Do.
1469. do	do	do	do	Do.
1470. do	do	Turist	R. A. McGrath	32 Indiana, Manila.
1471. do	do	Reo	Severino R. Alberto	672 Benavides, Manila.
1472. do	do	Overland	Hicks, Mantell and Hicks	722 Dakota, Manila.
1473. do	do	do	do	Do.
1474. do	do	do	do	Do.
1475. do	do	E. M. F.	P. F. Straub	Fort McKinley, Rizal.
1476. Motor cycle	do	Indian	Atlantic, Gulf & Pacific Co	Manila.
1477. do	do	Indian	Bureau of Constabulary	Do.
1478. Automobile	do	Brasier	T. B. Tolman	911 Urbiztondo, Manila.
1479. do	do	Overland	Luciano de la Rosa	572 Peñafrancia, Manila.
1480. Motor cycle	do	Indian	Bureau of Public Works	Manila.
1481. do	do	do	Jose P. Misa	87 Legaspi, Manila.
1482. Automobile	do	Overland	Dionisio Galvan	Bautista, Pangasinan.
1483. do	do	Brazier	Crescenciano Rebullida	923 Alburquerque, Manila.
1484. Motor cycle	do	N. S. U.	August Farner	C/o Kuenzle & Streiff, Ltd., Cebu.
1485. do	do	F. N.	L. Z. Burkess	Lingayen, Pangasinan.
1486. Automobile	do	Chalmers	Mariano A. Loesin	Daraga, Albay.
1487. Tricycle	do	Indian	F. E. D. Peanut Co	1000 Vergara, Manila.
1488. Ambulance	Ambulance	White	Quartermaster Dept., U. S. A	Manila.
1489. Motor cycle	Passenger	Merkel	Bert Terry	Daraga, Albay.
1490. Automobile	do	Hupmobile	William Benson	93 Lamayan, Manila.
1491. do	do	Everitt	Hicks, Hantell and Hicks	722 Dakota, Manila.
1492. Motor cycle	do	Excelsior	H. L. Porter	334 Vito Cruz, Manila.
1493. Automobile	do	Austin	Jose Mortera y Balsalobre	436 Nueva, Binondo, Manila.
1494. do	do	Hupmobile	A. P. Preston	704 Wright, Manila.
1495. do	do	Reo	Daniel Denniston	521 Sta. Mesa, Manila.
1496. do	do	American	Philippine Vegetable Oil Co	121 Arzobispo, Manila.
1497. Truck	Truck	Delahaye	Germinal Cigar Factory	Manila.
1498. Automobile	Passenger	Overland	Primitivo Mina	Victoria, Tarlac.
1499. Truck	Truck	Latil	Tomas Blanco	Sorsogon, Sorsogon.
1500. Automobile	Passenger	Cadillac	Fire Department city of Manila	Manila.
1501. Fire engine	Fire engine	do	do	Do.
1502. do	do	do	do	Do.
1503. do	do	Webb	do	Do.
1504. do	do	do	do	Do.
1505. do	do	Webb	do	Do.
1506. do	do	do	do	Do.
1507. do	do	do	do	Do.
1508. do	do	do	do	Do.
1509. do	do	do	do	Do.
1510. Truck	Truck	do	do	Do.
1511. do	do	do	do	Do.
1512. do	do	Aleo	do	Do.
1513. Automobile	Passenger	Hupmobile	Vicente Miranda	108 Arqueza, Manila.
1514. do	do	White	Bureau of Education	Manila.
1515. do	do	White	Bureau of Public Works	Manila.
1516. do	do	Buick	Lazaro Frias	427 Soler, Manila.
1517. do	do	Overland	Graciano Rodriguez	1652 Rizal Avenue, Manila.
1518. Truck	Truck	Gramm	Julio Danon	206 Palacio, Manila.
1519. Automobile	Passenger	Overland	Damian de los Santos	638 Trinidad, Manila.
1520. do	do	Brazier	Alfonso M. Tiaoqui	611 Sacristia, Manila.
1521. Motor cycle	do	Indian	Bureau of Education	Manila.
1522. Automobile	do	Overland	Pedro Buencamino	392 Raon, Manila.
1523. Truck	Truck	Gramm	Frank Smith	San Fernando, La Union.
1524. Automobile	Passenger	Buick	do	Do.
1525. do	do	Studebaker	C. S. Salmon	Pasay, Rizal.
1526. do	do	do	Valentin Racela	Lucena, Tayabas.
1527. Delivery wagon	Delivery wagon	Ford	Compañia Gral. de Tabacos	77 Canonigo, Manila.
1528. Motor cycle	Passenger	Merkel	Roy Kiene	Cebu, Cebu.
1529. do	do	Shaw	Catalino Valdezco	894 Rizal Avenue, Manila.
1530. do	do	N. S. U.	Antonio Sabater	90 Real, Intramuros, Manila.
1531. do	do	Indian	Bureau of Agriculture	Manila.
1532. Automobile	do	Brazier	J. J. Elisalde	153 Marina, Manila.
1533. do	do	Ford	Gregorio Limjoco	Batangas, Batangas.
1534. do	do	Brazier	Felix de la Rama	724 Sta. Mesa, Manila.
1535. do	do	Chalmers	Capt. R. B. Panott	Batangas, Batangas.
1536. do	do	Delahaye	Joaquin Inchausti	941 Real, Malate, Manila.
1537. do	do	Hupmobile	John C. Hoffmeister	Hotel Metropole, Manila.
1538. do	do	do	H. Lebreton	130 Escolta, Manila.
1539. do	do	Chalmers	Province of Albay	Albay, Albay.
1540. Motor cycle	do	F. N.	Henry L. De Weese	Bautista, Pangasinan.
1541. do	do	Indian	A. H. Donavan	Iloilo, Iloilo.
1542. Automobile	do	Overland	Lee Rogers	Batangas, Batangas.
1543. do	do	Hupmobile	Mrs. A. F. Allen	Elks Club, Manila.
1544. Truck	Truck	Aleo	Atlantic, Gulf & Pacific Co	Manila.
1545. Automobile	Passenger	Hupmobile	Severino B. Alberto	672 Benavides, Manila.
1546. do	do	Studebaker	Jose Machuca	3 Balmes, Manila.
1547. do	do	do	Claudio Sales	Tayabas, Tayabas.
1548. do	do	Hupmobile	Bureau of Public Works	Manila.
1549. do	do	do	Corazon Veloso	1057 Misericordia, Manila.
1550. do	do	do	Warwick Greene	C/o Bureau of Public Works, Manila.
1551. Motor cycle	do	Indian	M. E. Martin	Cabanatuan, Nueva Ecija.
1552. Truck	Truck	Gramm	House, Engle and Price	Tacloban, Leyte.
1553. Automobile	Passenger	E. H. F.	Benito de Leon	248 Sta. Mesa, interior, Manila.
1554. Motor cycle	do	Indian	J. B. Daugherty	1854 Azcarraga, Manila.
1555. Automobile	do	Hupmobile	Bureau of Public Works	Baguio, Benguet.
1556. Motor cycle	do	Indian	C. A. Shamotulaki	Caloocan, Rizal.
1557. do	do	do	Walter H. Anderson	Ft. McKinley, Rizal.
1558. Automobile	do	Hupmobile	A. R. Roxas	231 Gral. Solano, Manila.
1559. do	do	do	Vicente Ilustre	1067 Arlegui, Manila.
1560. do	do	do	Amparo Guisando	10 Hipodrome, Manila.
1561. Truck	Truck	White	Pangasinan Province	Lingayen, Pangasinan.

MOTOR VEHICLES TRANSFERRED FROM AUGUST 16, 1912, TO DECEMBER 15, 1912, INCLUSIVE.

Registry No. and type	Style.	Make.	Owner.	Address.	Transferred from—
46. Automobile	Passenger	Flanders	Gregorio R. Syquia	Vigan, Ilocos Sur	Cesar E. Arcinas.
53. do	do	Lambert	Maria Lechuga	Malolos, Bulacan	Maximo Cortes.
55. Motor cycle	do	Indian	J. H. Dawson	Fort McKinley, Rizal	Edward Ward.
80. Automobile	do	E. M. F.	G. A. Kauffmann	Manila Hotel	James P. Harbeson.
187. do	do	Ford	D. R. Williams	Manila	Geo. C. Sellner.
214. do	do	Reo	Primitivo Mina	Tarlac, Tarlac	German Limjap.
300. do	do	Hupmobile	Wm. M. Haube	C/o B. P. W.	Estrella del Norte.
327. do	do	Buick	Abelardo Lafuente	900 Libertad, Pasay	W. A. Kincaid.
329. do	do	Hudson	Lionel D. Hargis	50 Escolta, Manila	Agnes L. Freer.
362. do	do	E. M. F.	N. E. Thompson	44 Escolta, Manila	Pacific Commercial Co.
376. do	do	Renault	Jose R. Infante	34 Cortada, Ermita	Jose de Garchitorena.
402. Motor cycle	do	F. N.	J. J. Kelly	Manila	F. O. L. Killorn.
410. do	do	Indian	John R. Atkins	C/o Warner, Barnes Co.	William Daland.
467. Automobile	do	Buick	Gregorio Marquez	Lucena, Tayabas	Jose Varela y Calderon.
494. do	do	Flanders	Mariano Yulo	Bacolod, Occidental Negros	C. S. Salmon.
500. do	do	Overland	John E. Springer	50 Escolta, Manila	Josephine Finnich.
510. Motor cycle	do	Indian	Filemon R. Santos	933 S. Marcelino, Paco	Horacio Lorenzo.
730. do	do	do	Chas. F. Merten	Laoag, Ilocos Norte	Bureau of Posts.
764. do	do	do	Bureau of Posts	Manila	Chas. S. Merten.
824. do	do	do	H. R. Andreas	Nueva Caceres, A. C.	Vela Hermanos.
885. do	do	do	R. E. Shaw	C/o International Bank	Earl Johnson.
994. do	do	do	Elbert Clark	2 Nebraska	J. Bogatin.
1081. do	do	do	Jos. S. Johnston	Zamboanga, Moro	H. H. Ewing.
1086. Automobile	do	Richard-Brasier	Lim Tuico	200 Rosario, Manila	Vicente L. Legarda.
1226. do	do	Chalmers	Simplicio del Rosario	Manila	Joaquin Balmori.
16. do	do	Hudson	Benj. S. Houston	718 Georgia, Manila	Hugh Minturn.
36. Motor cycle	do	Indian	R. E. Kerr	San Fernando, Pampanga	J. M. Kerr.
51. do	do	do	T. M. Bieler	Riñan, Laguna	Ed. D. Gavagan.
56. do	do	do	Geo. J. Starling	Fort McKinley, Rizal	E. H. Dawson.
86. Automobile	do	Mitchell	Edwin Burke	2267 Anloague, Manila	J. C. McCollough & Co.
88. do	do	E. M. F.	Mrs. J. D. Fisher	Manila	B. F. Rahmeyer.
108. do	do	Overland	Louis R. Yangko	20th Century Bazar, Manila	Yanco Steamship Co.
110. do	do	do	Luisa Mañalak	1105 Soler, Manila	Antonio M. Mañalak.
116. do	do	do	Jose Ribas	322 Echague, Manila	Pedro Picornell.
150. do	do	Speedwell	John Shultz	Calawang, Laguna	Wm. H. Anderson.
255. Motor cycle	do	Indian	Sabino Piliño	914 Nueva, Malate, Manila	Agustin Gomes.
290. Automobile	do	Hudson	Jose Ma. Lopez	255 Solana, Manila	Jose F. Lafont Del Pan.
291. do	do	do	Jose F. Lafont	do	Jose Ma. Lopez.
292. do	do	do	Jose Ma. Lopez	do	Jose F. Lafont Del Pan.
300. do	do	Hupmobile	J. McGregor	C/o Bupubworks, Manila	Wm. M. Haube.
328. do	do	Flanders	Lorenzo Horacio	378 S. Sebastian, Manila	Petra Martin.
339. Motor cycle	do	Indian	W. B. Young	327 El Dorado, Manila	Robert C. Winfrey.
349. Automobile	do	Hudson	S. C. Choy	672 Anloague, Manila	Mauricio Cruz.
350. do	do	do	S. C. Choy	do	Do.
351. do	do	do	S. C. Choy	do	Do.
368. do	do	Mitchell	Hatsutaro Kawashima	13 Morillo, Manila	B. F. Rahmeyer.
411. do	do	Reo	Joseph Bialogivski	Bilibid Viejo, Manila	C. Alkan.
429. do	do	Dalahaye	Vicente Olegario	314 Azcarraga, Manila	Ramon R. Papa.
439. do	do	Hupmobile	Commercial Vehicle Co.	Manila	Manuel Tioeo.
537. Motor cycle	do	Indian	Louis D. Dellaronde	Ordinance Depot, Manila	Owen M. Adams.
614. Automobile	do	R. C. H.	J. W. Smith	34 Escolta, Manila	Arthur S. Allan.
617. do	do	Buick	Luisa Mañalak	1105 Soler, Manila	Sixto de los Angeles.
620. do	do	Everitt	J. Danon	206 Palacio, Manila	Manila Hotel Co.
821. do	do	do	J. Danon	do	Do.
822. do	do	do	C. G. de Arce	2128 Azcarraga, Manila	Do.
845. do	do	Buick	Vicente Olegario	314 Azcarraga, Manila	Mariano Fernandez.
860. do	do	Mitchell	Wm. J. Nicholson	Fort McKinley, Rizal	Charles M. Bunker.
874. do	do	Hupmobile	A. M. Jimenez	Vigan, Ilocos Sur	Estrella del Norte.
919. Motor cycle	do	Indian	J. A. Moore	Binalonan, Pangasinan	Irving W. Hammond.
939. Automobile	do	Brush	Jesus Vano	Cebu, Cebu	C. J. Milliron.
944. do	do	Mitchell	W. L. Ghent	Vigan, Ilocos Sur	Frank Smith.
962. Motor cycle	do	do	Jose Angulo	Talisay, Occidental Negros	Salvador de la Rama.
989. do	do	do	W. G. Buckisch & G. T. Luhrs	Bacolod, Occidental Negros	Eugene H. Rabun.
999. Automobile	do	Pathfinder	Bureau of Public Works	Manila	L. L. Cook.
1013. Motor cycle	do	Pierce	Lieut. F. H. Mills	Army and Navy Club, Manila	L. A. Stafford.
1016. do	do	Minnneapolis	I. F. Costellon	Lubao, Pampanga	F. W. Wood.
1018. Automobile	do	Chalmers	R. E. Spencer	Tabaco, Allay	Eugene Behrendt.
1054. do	do	Regal	Josefina Alcantara	320 Palacio, Manila	Joaquin Perez.
1098. Motor cycle	do	Indian	H. F. Moreland	Noveleta, Cavite	Ignacio Di-Tianguin.
1121. Automobile	do	Hupmobile	Salvador de la Rama	Talisay, Occidental Negros	Jose Angulo.
1124. do	do	Overland	H. T. Stapleton	Iloilo, Iloilo	G. W. Read.
1152. do	do	Cole	C. Alkan	100 Escolta, Manila	Joseph Bialoglovski.
1205. Delivery	Wagon	Rossemberg	Regino Castañeda	Rosales, Pangasinan	Primitivo Mina.
1206. Motor cycle	Passenger	Yale	W. R. McInteer	Ft. McKinley, Rizal	H. J. Williams.
1254. Automobile	do	Hudson	Roman P. Resurreccion	329 Ronquillo, Manila	Ricardo Gonzales.
1290. Truck	Truck	Gramm	Max. Blouse	Nva. Caceres, Ambos Camarines	J. Danon.
1442. Motor cycle	Passenger	Indian	Province of Pampanga	S. Fernando, Pampanga	Geo. Bellon.

LIST OF PERSONS LICENSED TO OPERATE MOTOR VEHICLES FROM AUGUST 16 TO DECEMBER 15, 1912, INCLUSIVE.

License No. and date issued.	Names and addresses.	License No. and date issued.	Names and addresses.
1227. August 16.	Jose Limcaco, 306 Madrid, Manila.	1249. August 22.	B. R. Landon, Iloilo, Iloilo.
1228. do	Angel Reyes, 179 Loreto, Manila.	1250. do	H. O'Leary, Iloilo, Iloilo.
1229. do	Florentino Cabral, 354 Madrid, Manila.	1251. August 23.	Tomas Samzon, 424 Int. 16 Pajardo, Manila.
1230. do	Leoncio Bautista, 306 Madrid, Manila.	1252. do	Catalino Atillo, 415 Peñalosa, Manila.
1231. August 17.	C. A. Grooves, Tacloban, Leyte.	1253. do	Antonio M. Mañalak, 634 Trinidad, Manila.
1232. do	C. I. Cullen, Catbalogan, Samar.	1254. do	L. V. Macken, Bacacay, Albay.
1233. do	Juan Carrion, 143 Aviles, Manila.	1255. do	Flaviano de la Cruz, Legaspi, Albay.
1234. August 19.	Pedro C. Andres, 358 San Rafael, Manila.	1256. August 24.	Gregorio Mangona, 16 Nagtahan, Manila.
1235. do	John E. Rader, Vigan, Ilocos Sur.	1257. do	Arturo Pujol, 2108 Herran, Manila.
1236. do	Fernando Morillo, 286 Solana, W. C., Manila.	1258. August 26.	G. A. Godfrey, C/o Bureau of Public Works.
1237. do	Paul Thos. Giovannini, Exile Stable, Manila.	1259. do	A. J. Gibson, 522 Nueva, Ermita, Manila.
1238. do	Marcos D. Cabañas, 1384 Felix Huertas, Manila.	1260. do	Emilio Paglinawan, 327 Zurbaran, Manila.
1239. do	Dionisio Carrasco, 244 Espeleta, Manila.	1261. do	J. R. Burns, 524 Alix, Manila.
1240. do	Julian Tubelleza, 120 Palacio, Manila.	1262. do	Filadelfo de Leon, Vigan, Ilocos Sur.
1241. do	Leon Escandor, 2129 Herran, Manila.	1263. do	Miguel Guerrero, 436 Herran, Manila.
1242. August 20.	Pastor Punongbayan, 362 G. Tuason, Manila.	1264. do	Santiago Martin, Pantat, Dagupan.
1243. do	Dr. Salvador I. Diy, 257 Lavaderos, Manila.	1265. August 27.	Balbino Lopez, 622 Salcedo, Manila.
1244. do	Mauricio Dimalanta, Germinal Cigar Factory.	1266. August 29.	Paul Doltz, Iloilo, Iloilo.
1245. do	Restituto Alparara, 450 Estero Binondo, Manila.	1267. August 30.	Eliseo Santos, Bacrach's Garage.
1246. August 21.	Paul Thos. Giovannini, Exile Stable, Manila.	1268. August 31.	C. L. Stone, 448 Real, Ermita, Manila.
1247. August 22.	Eugenio Solis, 170 Estero Binondo, Manila.	1269. do	R. M. Hendrickson, Baguio, Benguet.
1248. do	Ariston Bilbao, Iloilo, Iloilo.	1270. do	Eustaquio Taruba, 123 Leveriza, Manila.

List of persons licensed to operate motor vehicles from August 16 to December 15, 1912—Continued.

License No. and date issued.	Names and addresses.	License No. and date issued.	Names and addresses.
1271. August 31.	Domingo Abueva, Lucena, Tayabas.	1384. September 19	Geo. M. Harvey, 112 San Marcelino, Manila.
1272. do	C. E. Wright, Capiz, Capiz.	1385. September 20	John C. Graham, Los Baños, La Laguna.
1273. do	W. M. Gracey, Capiz, Capiz.	1386. do	D. Glenn Gregg, Lingayen, Pangasinan.
1274. do	H. H. Ewing, Zamboanga, Moro.	1387. do	Patricio Estalilla, 821 Singalong, Manila.
1275. September 2	Cornelio Desiderio, 121 Palomar, Manila.	1388. September 21	Marcelino Azuado, 1035 San Marcelino, Manila.
1276. September 3	W. T. R. Price, Baguio, Benguet.	1389. do	Benifacio Sibug, 6 Villalobos, Manila.
1277. do	Eladio Muñoz, Baguio, Benguet.	1390. do	Mrs. F. Crosby, 709 Colorado, Manila.
1278. do	Theodore Lepage, Baguio, Benguet.	1391. September 23	Jose Hidalgo, S. Juan de Letran, Manila.
1279. do	Patricio Mistal, Baguio, Benguet.	1392. do	John Calbert, Land. Transp., Manila.
1280. do	Severino Romero, Baguio, Benguet.	1393. do	Ramon Mosteio, 34-36 Marañon, Cebu.
1281. do	Arcadio Francisco, Baguio, Benguet.	1394. do	Fidel Reyes, Vigan, Ilocos Sur.
1282. do	Dalmacio Gismundo, Baguio, Benguet.	1395. do	Arthur E. Haley, C/o Bureau of Public Works, Manila.
1283. do	Julio Manalastas, Baguio, Benguet.	1396. September 24	Pedro Castañeda, 868 Rizal Avenue, Manila.
1284. do	Francisco Torres, Baguio, Benguet.	1397. September 25	Jane D. Loper, 608 Nozalea, Manila.
1285. do	Julian Teves, Baguio, Benguet.	1398. do	Henry H. Boyle, C/o Bu. Agriculture, Manila.
1286. do	Domingo Enrile, Baguio, Benguet.	1399. September 26	Carl L. Stone, Captain Philippine Scout, Manila.
1287. do	Domingo, Espiritu, Baguio, Benguet.	1400. do	Jos. T. Hurley, Baguio, Benguet.
1288. do	Francisco Romina, Baguio, Benguet.	1401. do	Hermínio Maravilla, Saravia, Occidental Negros.
1289. do	Pedro Lardizabal, Baguio, Benguet.	1402. do	Pedro Maravilla, Saravia, Occidental Negros.
1290. do	Felix Hufana, Baguio, Benguet.	1403. do	Cirilo Ablaza, 165 G. Tuson, Manila.
1291. do	Pedro Torio, Baguio, Benguet.	1404. September 27	Monico Arevalo, Nueva Caceres, Ambos Camarines.
1292. do	Florentino Miranda, Baguio, Benguet.	1405. do	E. N. Woodbury, Fort Mills, Cavite.
1293. do	Leon Fulaton, Baguio, Benguet.	1406. September 28	Jacinto Bacongan, 40-44 Alhambra, Manila.
1294. do	Ramon Carrillo, Baguio, Benguet.	1407. do	Guillermo Rueda, 429 Misericordia, Manila.
1295. do	Pedro Garcia, Baguio, Benguet.	1408. September 30	R. M. McCrory, Zamboanga, Moro.
1296. do	Santiago Fernandez, Baguio, Benguet.	1409. do	Jos. S. Johnston, Zamboanga, Moro.
1297. do	Valeriano Gabina, Baguio, Benguet.	1410. do	Stanislaw Pawski, Paco Fire Station, Manila.
1298. do	Benigno Estrada, Baguio, Benguet.	1411. do	Servio Alvarez, Sta. Maria, Zamboanga.
1299. do	Guillermo Melendres, Baguio, Benguet.	1412. do	Pedro Medallo, Pantayan, Zamboanga.
1300. do	Leopoldo Azucena, Baguio, Benguet.	1413. do	J. Blake-Hedges, Zamboanga, Moro.
1301. do	Alejandro Guiharde, Baguio, Benguet.	1414. do	John W. Jones, 34-37 Plaza, Ermita, Manila.
1302. do	Meliton Geronimo, Baguio, Benguet.	1415. do	Robt. P. Sherman, 54 Nueva, Ermita, Manila.
1303. do	Jacinto Quezada, Baguio, Benguet.	1416. October 1	Timoteo Clemente, 322 Lavezares, Manila.
1304. do	Lucas Pacibe, Baguio, Benguet.	1417. do	Delin R. Valencia, Silay, Occidental Negros.
1305. do	Lucas Gatica, Baguio, Benguet.	1418. do	Jose Ma. Laeson, Talisay, Occidental Negros.
1306. do	German de Leon, 1 Castillejos, Manila.	1419. do	Gerardo Alunan, Talisay, Occidental Negros.
1407. do	Catalino Cruz, 1184 Singalong, Manila.	1420. do	Domingo Vicente, Silay, Occidental Negros.
1308. September 4	Nicolas A. Lizares, Talizay, Occidental Negros.	1421. October 2	E. A. Cuddy, 682 Anloague, Manila.
1309. do	Paul Whitane, Lingayen, Pangasinan.	1422. do	Benigno Damian, 88 Villanuel, Pasay.
1310. do	Francisco Liongson, Bacolor, Pampanga.	1423. do	Roy Baxter, L. F. C., Manila.
1311. do	Ray O. Porter, Bureau of Agriculture, Manila.	1424. October 3	Ovid L. Hall, 183 Lardizabal, Manila.
1312. do	Sixto Yunsay, Silay, Occidental Negros.	1425. do	T. L. Donaldson, Fort McKinley, Rizal.
1313. September 5	Geo. P. Neman, Baguio, Benguet.	1426. do	Roland James, 1331 Herran, Manila.
1314. do	Adam C. Dekum, Bulacan, Bulacan.	1427. do	Daniel J. Grecia, Jaro, Iloilo.
1315. do	Procopio Velasco, Molo, Iloilo.	1428. do	Jose Jaluena, Jaro, Iloilo.
1316. September 6	U. G. McAlexander, Army and Navy Club.	1429. October 5	W. C. Clark, 163 Lardizabal, Manila.
1317. September 7	M. C. Caraso, 317 San Marcelino, Manila.	1430. do	Agustin Ubaldio, 148 Rizal Avenue, Manila.
1318. do	Ulpiano Fiel, 113 Legaspi, Manila.	1431. do	Frank F. Becker, San Fernando, La Union.
1319. do	Marcelino Panaligan, 1175 Magdalena, Manila.	1432. do	A. P. Draksford, 431 Camba, Manila.
1320. do	Francisco Arcilla, 715 Dakota, Manila.	1433. do	Moises F. Tuason, 50 Nadurata, Calocan, Rizal.
1321. do	Estanislao Sambania, 23 Echague, Manila.	1434. do	Gaudencio Beltran, 318 G. Tuson, Manila.
1322. do	Nicolas Stylianopoulos, 405 Aviles, Manila.	1435. do	Myra Louisa Parsons, 430 Real, Ermita, Manila.
1323. do	Estanislao Manalo, San Nicolas, Tarlac.	1436. October 7	Frank E. Nichols, Bacolor, Occidental Negros.
1324. do	James Hickman, Box 1144, Manila.	1437. do	J. R. Barry, Los Baños, Laguna.
1325. do	Enrique Lima, 341 Magdalena, Manila.	1438. do	German Carballo, Bacolor, Occidental Negros.
1326. do	Juan Aquino, 1665 Oroquieta Int., Manila.	1439. do	J. L. Myers, Marikina, Rizal.
1327. do	Francisco Ferrer, San Pedro Macati, Rizal.	1440. do	Crisanto Aquino, 88 Singalong, Manila.
1328. September 9	Ambrosio Villareyes, 218 Nueva, Ermita.	1441. do	Vicente Quigone, 413 Carriedo, Manila.
1329. do	Servio Langdix, 9 Palma, Manila.	1442. do	Eugene H. Hawk, U. S. Navy U. S. Mohican.
1330. do	Herald F. Lewis, Co. L. Signal Corps, Fort McKinley.	1443. October 8	Frank Rhodes, 135 M. Comillas, Manila.
1331. September 10	Silverio V. Estimo, Bacrach's Garage, Manila.	1444. do	W. Bashore, Magallanes, Manila.
1332. do	Victor Ferrer, 610 Paz, (Paco) Manila.	1445. do	Flaviano Caballero, 1267 Sande, Manila.
1333. do	R. B. Hamilton, Luzon Brokerage Co., Manila.	1446. do	M. L. Gonzalez, Bautista, Pangasinan.
1334. do	Chas. C. Mortimer, Fort McKinley, Rizal.	1447. do	Fortunato Hallera, 403 El Dorado, Manila.
1335. September 11	Mentor M. Boney, Y. M. C. A.	1448. do	Frank Thomason, Lingayen, Pangasinan.
1336. do	Gervasio Buacaco, 1638 Anloague, Manila.	1449. do	M. E. Morris, Capt. Phil. Scout, Manila.
1337. do	Sixto Zarate, Bazar Siglo XX, Manila.	1450. October 9	Salvador de la Rama, Talisay, Occidental Negros.
1338. do	Miguel Mexia, 743 Almanza, Manila.	1451. do	Leopoldo Mijares, Bacolor, Occidental Negros.
1339. do	Carl B. Crabtree, Bacolor, Occidental Negros.	1452. do	Emilio Gaston, Silay, Occidental Negros.
1340. do	Simplicio Lizares, Talisay, Occidental Negros.	1453. do	Ygino Latorre, Silay, Occidental Negros.
1341. do	Herbert Campbell Phelan, 28 Cortada, Manila.	1454. do	Emilio Cortez, Bago, Occidental Negros.
1342. do	Fernando David, 346 Cabildo, Manila.	1455. do	Federico Nva. España, Bago, Occidental Negros.
1343. do	I. R. Grosvenor, Iloilo, Iloilo.	1456. do	Anastacio Montero, 134 Felix Huertas, Manila.
1344. September 12	V. S. Kilby, Iloilo, Iloilo.	1457. do	Luis Y. Lopez, 711 Zaeateros, Manila.
1345. do	Chas. E. Lucas, Iloilo, Iloilo.	1458. October 10	Antonio A. Luminato, 617 Nozalea, Manila.
1346. do	Francisco Gutierrez, 827 Real, Malate, Manila.	1459. do	José Lopez, Jaro, Iloilo.
1347. do	Felipe Gomez, Iloilo, Iloilo.	1460. do	N. Richmond Baugh Nva. Caceres, Ambos Cam.
1348. do	Teodoro Fernandez, 912 Benavides, Manila.	1461. do	Florencio de la Peña, Iloilo, Iloilo.
1349. do	Chas. A. Cragin, C/o Land Transportation.	1462. do	W. H. Smith, Fort McKinley, Rizal.
1350. September 13	Domingo Nebres, C/o Erlanger-Galinger.	1463. do	Isabelo C. Pineda, 128 Benavides, Manila.
1351. do	Cirilo Santos, C/o Erlanger 2 Manila.	1464. October 11	Atanacio Mendoza, 430 Estero Cegado, Manila.
1352. do	Lucio Ranollo, Malacanan Palace, Manila.	1465. do	Placido Balgue, 114 Sta. Rosa, Manila.
1353. do	Felix Valdis, Carcar, Cebu.	1466. October 12	C. R. Gerber, M. O. D., 31 Cabildo, Manila.
1354. do	Pablo Minor, Martires, Cebu, Cebu.	1467. do	Salvador Zaragoza, 1030 S. Sebastian, Manila.
1355. do	Benj. S. Houston, 718-B Georgia, Manila.	1468. do	E. A. Kingcome, Guadalupe House, Cebu.
1356. do	W. J. Grodsky Jr., C/o Bureau of Public Works, Manila.	1469. November 15	R. S. Percival, Santolan, Rizal.
1357. September 14	E. C. Earle, 1256 Leveriza, Manila.	1470. October 12	Antonio C. Torres, Phil. Assembly, Manila.
1358. September 16	J. O. Wagner, Baguio, Benguet.	1471. do	Miguel Amongo, Phil. Sepulcro, Manila.
1359. do	Andres Reyes, Sta. Rosa, Laguna.	1472. do	A. Algar, 507 Sto. Sepulcro, Manila.
1360. do	A. V. Johnston, Baguio, Benguet.	1473. do	Cliff C. Barton, 507 Sto. Sepulcro, Manila.
1361. do	S. R. Sweet, Batangas, Batangas.	1474. do	Geo. G. Ball, C/o Bureau of Public Works, Manila.
1362. do	L. D. Gregg, La Carlota, Occidental Negros.	1475. do	Walter E. Hausheer, 343 S. Jacinto, Manila.
1363. do	Carroll E. Atwood, Rebellin, Manila.	1476. October 14	Crispin Celuya, 1102 Castillejos, Manila.
1364. do	Damaso Sison, 49 Elena Int., Manila.	1477. do	H. W. Fisher, Cebu, Cebu.
1365. do	Alexander Mann, Philippine Cold Stores, Manila.	1478. do	Fidel Villonco, S. Pedro Macati, Rizal.
1366. do	William T. Roe, Philippine Constabulary, Manila.	1479. October 15	Fred H. Mills, Army and Navy Club, Manila.
1367. do	Ramon Ilagan, 67 Legaspi, Manila.	1480. do	Felix Laeson, Silay, Occidental Negros.
1368. September 17	C. D. Whipple, San Isidro, Nva. Ecija.	1481. do	Luis Dibinagrancia, Silay, Occidental Negros.
1369. do	Matias Servanez, 320 Penarubia, Manila.	1482. do	Geo. T. Luhrs, Bacolor, Occidental Negros.
1370. do	Teodoro Lopez, 255 Solona, Manila.	1483. do	W. G. Buckisch, 910 Nueva, Malate, Manila.
1371. do	Domingo Padilla, 605 Sales, Manila.	1484. do	E. M. Kneeder, 910 Nueva, Malate, Manila.
1372. September 18	Celso Dayrit, San Fernando, Pampanga.	1485. do	Cirilo Villamor, Lucena, Tayabas.
1373. do	Melencio Dizon, San Fernando, Pampanga.	1486. October 16	Hugo R. Fernandez, 339 Caballeros, Manila.
1374. do	Silvestre Velarde, San Pedro, Manila.	1487. do	Vicente Olegario, 314 Azcarraga, Manila.
1375. September 19	John R. Atkins, C/o Warner Barners Co. Manila.	1488. October 17	Fred L. Martin, Capas, Tarlac.
1376. do	Fernando Zobel, 165 M. Comillas, Manila.	1489. do	Geo. K. Lewis, Vigan, Ilocos Sur.
1377. do	Rufino Antiado, 16 Basco, Manila.	1490. October 18	Jose Polido, 306 Palomar, Manila.
1378. do	Eugenio V. Solis, 179 Estero Binondo, Manila.	1491. do	Pedro de Albino, Nueva Caceres, Ambos Camarines.
1379. do	Crispulo Rosado, Silay, Occidental Negros.	1492. October 19	H. F. Kern, San Fernando, Pampanga.
1380. do	Esteban de la Rama, 28 Progreso, Iloilo.	1493. do	Rufino Gampi, Sampaloc Convent, Manila.
1381. do	J. B. Nelson, Iloilo, Iloilo.	1494. October 21	F. David Sholin, Zamboanga, Moro.
1382. do	Jose Ledesma, Jaro, Iloilo.	1495. do	Feliciano de la Cruz, 366 Nozalea, Manila.
1383. do	Juan Ledesma, Jaro, Iloilo.	1496. do	Luis Cuayson, Talisay, Occidental Negros.

List of persons licensed to operate motor vehicles from August 16 to December 15, 1912—Continued.

License No. and date issued.	Names and addresses.	License No. and date issued.	Names and addresses.
1497. October 21	E. A. McCreary, Bacolod, Occidental Negros.	1570. November 8	Alipio Dol, 1377 Anloague, Manila.
1498. do	C. H. Bowers, Bacolod, Occidental Negros.	1571. do	Francisco Gacer, San Pedro Macate, Rizal.
1499. do	T. A. Baumeister, Bacolod, Occidental Negros.	1572. do	Gregorio Antonio, 944 Antonio Rivera, Manila.
1500. do	H. L. Cooper, Land Transportation Corral, Manila.	1573. do	Dalmacio Rea, 131 Real, Ermita, Manila.
1501. October 22	Julio Ledesma, Saravia, Occidental Negros.	1574. do	A. J. Dougherty, Camp Keithly, Mindanao.
1502. do	Hugh McKenzil, 215 Anloague, Manila.	1575. do	Teodoro de Leon, 1528 Sande, Manila.
1503. October 23	Frank Smith, Jr., San Fernando, La Union.	1576. do	Federico Tionson, Malolos, Bulacan.
1504. do	D. D. B. Bunker, 468 Real, Ermita, Manila.	1577. November 11	Ignacio Aluminis, 176 Rodriguez, Manila.
1505. do	Philip Holliday, 316 Sagat, Paco, Manila.	1578. do	Demetrio Tionson, 27 Magallanes, Manila.
1506. do	Jose P. Katigbak, City Hall, Manila.	1579. do	Juan de Vera, C/o San Lazaro Hospital, Manila.
1507. do	Wm. H. Warner, 1033 Felix Huertas, Manila.	1580. November 12	Fortunato Castro, 710 Elcano, Manila.
1508. October 24	Dana Q. McComb, Tacloban, Leyte.	1581. do	W. C. McGill, Calamba, Laguna.
1509. do	John A. Shaw, City Hall, Manila.	1582. do	Juan Calasada, 26 Palacio, Manila.
1510. do	Antonio Florentino, Manzanadan, Pangasinan.	1583. November 13	Antonio R. Roxas, 231 Gral. Solano, Manila.
1511. do	Federico F. Brown, 183 Bustillos, Manila.	1584. do	Lucas Dizon, 724 Benavidez, Manila.
1512. do	Feliciano Sandoval, C/o T. N. Hashim & Co., Manila.	1585. do	John C. Howe, 707 Wright, Manila.
1513. do	Edwin Burke, 2207 Anloague, Manila.	1586. do	R. A. McGrath, 32 Indiana, Manila.
1514. do	L. L. Bridenstine, Iloilo, Iloilo.	1587. November 14	Pedro Pablo, 993 Real, Pasay, Rizal.
1515. do	Sam. H. Sherard, Iloilo, Iloilo.	1588. do	Jose Lacson y de Paula, Talisay, Occidental Negros.
1516. October 25	W. A. McVean, Los Baños, Laguna.	1589. do	Baldomero Vasquez, 47 Nueva, Ermita, Manila.
1517. do	W. W. Richards, 1026 Felix Huertas, Manila.	1590. do	Gervacio Tapon, 96 Real, Ermita, Manila.
1518. do	Benjamin Mexio, C/o International Banking Corporation.	1591. November 15	Justino C. Pacheco, 7 7 Alvarado, Manila.
1519. do	Wm. F. Hart, 442 Leveriza, Manila.	1592. do	Cristobal Regidor, 628 Herran, Manila.
1520. do	Mrs. W. E. McMahon, Legaspi, Albay.	1593. do	Ramon F. Alberto, 924 Santol, Manila.
1521. do	Carroll Fox, C/o Bureau of Health, Manila.	1594. do	C. C. Chapman, Fort McKinley, Rizal.
1522. do	H. C. Liehenow, City Hall, Manila.	1595. do	Paul I. Keeler, C/o Y. M. C. A., Manila.
1523. October 26	Aracadio de los Santos, San Miguel, Bulacan.	1596. November 16	J. W. Robblee, Pototan, Iloilo.
1524. do	Albert O. Field, 2421 Herran, Manila.	1597. November 18	Venancio Moreto, Tacloban, Leyte.
1525. October 28	Eugenio Repasa, 1316 Herran, Manila.	1598. do	Pio Arellano, Bacolod, Occidental Negros.
1526. do	T. Hohener, 2559 Lico, Manila.	1599. do	J. Patty, Macleod & Co., Cebu.
1527. do	Wm. E. Davis, Legaspi, Albay.	1600. do	Julian Leonilla, Bacolod, Occidental Negros.
1528. do	Eladio Cirera, Bacolod, Occidental Negros.	1601. November 19	Pascual Umali, 206 Palacio, Manila.
1529. do	Manuel Alvares, Bacolod, Occidental Negros.	1602. do	J. W. Smith, 34 Escolta, Manila.
1530. do	Isaac Lacson, Talisay, Occidental Negros.	1603. do	Jose P. Misa, 87 Legaspi, Manila.
1531. do	Crispin Lacson, Talisay, Occidental Negros.	1604. do	Dionisio Galvan, Bautista, Pangasinan.
1532. do	B. Nolan, Bacolod, Occidental Negros.	1605. do	C. F. Vance, Catbalogan, Samar.
1533. October 29	Bruno Posadas, San Fernando, La Union.	1606. November 20	Dionisio Constantino, Tacloban, Leyte.
1534. do	J. G. Owen, M. E. R. R. & L. Co., Manila.	1607. November 21	E. H. Teal, Hotel de Francia, Manila.
1535. do	F. M. Vanderveer, M. E. R. R. & L. Co., Manila.	1608. do	Crescenciano Rebullida, 923 Alburquerque, Manila.
1536. do	Severino Garcia, 99 Muralla, Manila.	1609. do	August Farner, Kuenzle & Streiff, Cebu.
1537. October 30	S. H. McLean, Fort McKinley, Rizal.	1610. November 22	Bonifacio Bautista, 12 Taft Avenue, Manila.
1538. do	Justo Ramos, Lucena, Tayabas.	1611. November 23	Paciano P. Villarosa, Lucena, Tayabas.
1539. do	Mauricio Brulay, Iloilo, Iloilo.	1612. do	Fermin Barrenechea, Legaspi, Albay.
1540. do	E. R. Knapp, Bako, Occidental Negros.	1613. do	Pert Terry, Regan Barracks, Albay.
1541. do	Romaldo Tagaytayan, Hda. Paz, Occidental Negros.	1614. do	William Benson, 93 Lamayan, Manila.
1542. October 31	C. J. Calley, M. E. R. R. & L. Co., Manila.	1615. do	Mariano A. Locsin, Albay, Albay.
1543. do	Matias Camanong, 626 Sta. Mesa, Manila.	1616. November 25	Macario Ebanó, Legaspi, Albay.
1544. do	Pearl Garland, Fort McKinley, Rizal.	1617. do	D. Ree, Villalon, Albay, Albay.
1545. do	Esteban Siruet, 1232 Leveriza, Manila.	1618. do	Leoncio Imperial, Albay, Albay.
1546. November 1	Vicente Miñon, 127 Magallanes, Manila.	1619. do	Harry K. Rankin, Baguio, Benguet.
1547. November 2	Romualdo Aguilar, Lucena, Tayabas.	1620. do	James F. Dumphy, Zamboanga, Moro.
1548. do	A. M. Jimenez, 72 Magallanes, Manila.	1621. do	C. G. de Arce, 2 28 Azcarraga, Manila.
1549. November 4	W. A. Elliott, 803 Alfonso, Manila.	1622. November 26	D. Denniston, 521 Santa Mesa, Manila.
1550. do	G. W. Thompson, Tacloban, Leyte.	1623. do	Lt. O. H. Newton, Santo Domingo Barracks, Laguna.
1551. do	L. J. Williams, Guagua, Pampanga.	1624. do	Santiago Maravilla, 104 Looban, Manila.
1552. do	Soon Ho Lo., 209 Sto. Cristo, Manila.	1625. November 27	Antonio F. Baltaser, 1092 Arlegui, Manila.
1553. do	Jose A. Lacson, Talisay, Occidental Negros.	1626. do	W. C. Taylor, San Fernando, La Union.
1554. do	Jens Bugge, Fort McKinley, Rizal.	1627. November 29	Martiniano Bautista, 2656 Lico, Manila.
1555. November 5	Wm. G. Ghent, Vigan, Ilocos Sur.	1628. do	Arthur H. Ames, Nueva Caceres, Ambos Camarines.
1556. do	W. F. Root, Vigan, Ilocos Sur.	1629. do	Arsenio D. Fernando, 1030 Bilibid Old, Manila.
1557. November 6	F. E. Baughman, 233 San Rafael, Manila.	1630. do	H. F. Moreland, Noveleta, Cavite.
1558. do	Juan Eusebio, 129 Magallanes, Manila.	1631. November 30	Marcelo A. Romasanta, 88 Arlegui, Manila.
1559. do	Isidro V. Sanoy, 180 M. Comillas, Manila.	1632. December 2	Ramon de Guzman, 146 Lamayan, Manila.
1560. do	Martin Samaniego, 1377 Anloague, Manila.	1633. do	W. R. Giberson, Cebu, Cebu.
1561. November 7	Jack W. Heard, Fort McKinley, Rizal.	1634. December 3	Daniel de la Cruz, C/o Commercial Vehicle Co., Manila.
1562. do	Andres Policarpio, 1145 Agno, Manila.	1635. do	Capt. R. B. Panott, Batangas, Batangas.
1563. do	Rufino Abad, Pototan, Iloilo.	1636. December 4	Manuel Ramirez, 87 Alejandro VI, Manila.
1564. do	A. C. Montelibano, Concepcion, Iloilo.	1637. December 5	Henry L. De Weese, Bautista, Pangasinan.
1565. do	H. T. Stapleton, Chartered Bank, Iloilo.	1638. do	Agustin Dacanay, 72-B Teodora Alonso, Manila.
1566. do	Pedro Rivera, 218 San Miguel, Manila.	1639. December 6	A. H. Donavan, Iloilo, Iloilo.
1567. November 8	A. M. Jimenez, Vigan, Ilocos Sur.	1640. do	Ignacio A. S. Prado, 628 Salcedo, Manila.
1568. do	A. P. Brown, C/o Internal Revenue Bureau, Manila.	1641. December 12	Emilio Nalda, 1177 Sandejas, Manila.
1569. do	Francisco Sta. Maria, 134 Sta. Lucia, Manila.		

APPENDIX C.

PROJECTS ACTIVE OCTOBER 1, 1912.

Provinces.	Road.				Bridges and culverts.				Provincial administration buildings.		Municipal administration buildings.		Prisons.		Schools.				Construction and operation.													
	Construction.	Maintenance.	Repair.	Reconstruction.	Construction.	Maintenance.	Repair.	Reconstruction.	Construction.	Maintenance.	Repair and alteration.	Construction.	Reconstruction.	Construction.	Repair and alteration.	Construction.	Maintenance.	Repair and alteration.	Reconstruction.	Markets.	Parks, grounds, and athletic fields.	Miscellaneous buildings.	Ferries.	Water systems.	Record vaults.	Quarries.	Telephone lines.	Electric light plant.	Miscellaneous.	Total.		
Albay	2	2			2						1					11														4	22	
Ambos Camarines	2	2			2	1					1		1			7														3	19	
Antique	4	11	1		4						1						1													2	25	
Bataan	1	4			1	1		1																						3	10	
Batangas	1	5	1		2	1	1				1		1			4				2	1	4	1							3	28	
Bohol	1	3	1		1						1					4														3	28	
Bulacan	2	9	1	5	1	1	1									2				1			1	1						1	24	
Cagayan	1	2			4	1					1		1	1																2	14	
Capiz	14	14			5	4										3				1	1	2								3	47	
Cavite	2	2			1											5				1											11	
Cebu	5	9			7	1								1		14		3												3	26	
Ilocos Norte	1	2			2											10			1	1										3	26	
Ilocos Sur	15	19	5		8	1		1					1	1		1				5		1								7	64	
Iloilo	2	16	2	1	2											1		1												2	39	
Isabela	1	2			2											10				3			1	2		1	1				9	
Laguna	4	3	1	1	1	1	1	1								9														4	31	
La Union	4	5	1		5			1					2			1			1											3	17	
Leyte	1	4			6				1							1			1												1	17
Misamis	4	4			2	1										2						1	1							2	15	
Nueva Ecija	1	2			4				1							8				1	1		1							21		
Occidental Negros	7	11	1		10	1										5								1						3	35	
Oriental Negros	5	1			1	1			2							3				4	1									3	17	
Pampanga	1	2			3	1					1		1			2														3	20	
Pangasinan	3	8		1	13	1							2			2			2	1	1		1	1						4	45	
Rizal	3	11	5		1		1									2				1										4	28	
Samar	1	5							1					1		2								1							11	
Sorsogon	1	2			2											4		1												3	13	
Surigao	1	3														7				1										1	13	
Tarlac	2	3			3		1							1		8						1								2	19	
Tayabas	6	5	2		3		1									3		1			1			1						2	26	
Zambales		1			2										1																2	6
Total	98	172	21	8	112	17	6	4	5	4	4	7	4	4	2	135	2	7	4	21	5	9	5	7		2	1	1	73	740		

The 73 miscellaneous projects include 26 surveys and investigations, 1 river control, etc.

